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Team Teaching in a High School Science - Chemistry

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TEAM TEACHING IN A HIGH SCHOOL SCIENCE - CHEMISTRY

by

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LIFE

Michael Lawrence Agin was born in Chicago, Illinois, on December 12, 1933.

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CHAPTER I

INTRODUCTION TO THE STUDY

Genesis and History

There is always a need for an improvement in the quality of education. This need requires constant reappraisal of the methods and techniques of instruction used in the schools of our country. Through the years educational planning has developed a pattern which has required teachers to meet with a definite number of students at a specific time every day. Although this pattern of teaching has almost become a tradition, it is no longer possible to present the volume of material demanded by our "education-minded" society. Even if a teacher was capable he could not find sufficient hours to effectively plan and present this wealth of information.

Faced with the problem of securing competent personnel and compensating for time deficiencies, educators are attempting to devise more efficient teaching techniques. These techniques are designed to relieve the teacher of some of the tedious daily responsibilities and allot more time for better planned learning experiences. One of the methods proposed by educators to better utilize the faculty is team teaching.

Team teaching is a method of instruction in which two or more persons are assigned to the same groups of students at the same time. These persons share the responsibility for the instruction of the students. This method assumes various organizational forms, depending upon the number of teachers and students involved and the subject or subjects being taught. There are opportunities for having large-group meetings, small-group seminars and independent study. A more detailed description of team teaching will be presented later.

The actual origin of team teaching has been difficult to pinpoint. The principle involved in this method has been in existence for many years. Many Sunday schools practice a modified form of team teaching by meeting to study and discuss the sermon for that week. Following these classes, the children go to church to hear the sermon. In scholastic athletics where the head coach is aided by assistants with different specialties, this principle is illustrated in a slightly varied form. Elementary schools have practiced a simplified form of team teaching for many years. Here, students in the sixth, seventh and eighth grades have different teachers for English, arithmetic, science and art. The students under this "departmental" plan spend one hour daily with each of the teachers. Music is taught by a fifth teacher one afternoon every week. Numerous examples of the team teaching principle are present at all levels of education.

Although the principle of team teaching has been in existence for a long time, the term "team teaching" is very new. This topic does not appear in the literature before 1958, even though the method was under serious consideration before then.

In 1954 and 1955, the National Association of Secondary School Principals' Committee on Curriculum Planning and Development[1], held discussions on staff utilization. The first financial grant by the Fund for Advancement of Education (The Ford Foundation) to support experimentations of staff utilization was announced in February, 1956. During the spring of the same year, the Executive Committee of the NASSP appointed a Commission on the Experimental Study of the Utilization of the Staff in the Secondary School to conduct and evaluate the studies of staff utilization.[2] The Commission was concerned with all aspects of staff utilization, of which team teaching was one. It was responsible for the dissemination of information about staff utilization, which stimulated experimental studies of team teaching.[3]

In September of 1957, Benjamin Franklin School, Lexington, Massachusetts, began what is considered to be one of the first

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[1]Hereafter, this organization will be referred to as NASSP.

[2]J. Lloyd Trump, "Brief History and Recommendations of the Commission on the Experimental Study of the Utilization of the Staff in the Secondary School", NASSP. Bulletin XLVI (January 1961), 275.

[3]Ibid. 277.

programs of team teaching. This project consisted of three teaching teams. Each team consisted of three teachers with one teacher of each team acting as the team leader.

Evanston Township High School, Evanston, Illinois, initiated its first teacher-team projects the same year. The pioneer projects were a course in Senior English for 240 students taught by two teachers and a speech arts survey course for 100 Freshmen taught by four teachers.

These projects employed varying class sizes (twenty students for discussions, 200 for lectures), increased use of teaching aides, use of audio-visual aids, especially closed-circuit television, the overhead projector and modern electronic language laboratory equipment. The English Department employed lay readers to correct English compositions. These projects were conducted for two years.

A fairly widespread development of team teaching programs has sprung from this meager beginning. Numerous team teaching projects were initiated in September, 1958. J. Sterling Morton High School, Cicero, Illinois, embarked upon a two-year experimental project in which American history and literature were coordinated into a unified course.[4]

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[4]Walter L. Cooper, "J. Sterling Morton High School and Junior College, Cicero, Illinois, Uses Tapes, Language Laboratory and Team Teaching", NASSP. Bulletin, XLV (January 1961), 80.

In the same school year, several other noteworthy projects were undertaken. A course in American history involving sixty students and two teachers was begun at Rich Township High School, Park Forest, Illinois.[5] The University of Chicago Laboratory School, Chicago, Illinois, established an experiment with a five-member teaching team and Freshmen students.[6] Glenbrook High School, Northbrook, Illinois, started several team teaching projects at all levels of high school, but the course content was the same as for the regular classes.[7] A final example is the Arlington Heights Township High School, Arlington Heights, Illinois, where the form of team teaching employed teaching aides in remedial mathematics courses.[8]

The school year beginning September, 1959, ushered in a great expansion of team teaching. Before 1958, information about team teaching was not available in the literature. During the period of July, 1958, to June, 1959, only eight projects were

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[5]Will Hermeyer and Jean B. McGrew, "Big Ideas for Big Classes", The School Review, LXVIII (Autumn 1960), 308-317.

[6]Robert Hanvey and Morton S. Tenenberg, "University of Chicago Laboratory School, Chicago, Illinois, Evaluates Team Teaching", NASSP. Bulletin, XLV (January 1961), 189-197.

[7]Francis M. Trusty, personal correspondence.

[8]Harold L. Slichenmeyer, "Arlington Heights, Illinois, Studies Curriculum and Testing, Instruction Assistants, Team Teaching and Modern Technology in Fourteen Projects", NASSP. Bulletin, XLV (January 1961), 47.

reported in journals. The following year, July, 1959, to July, 1960, thirty-five team teaching projects were reported in operation or in the stage of organization. Nineteen new projects were presented in the literature from July, 1960, to June, 1961.[9] The actual degree of expansion of this method has been difficult to determine because information about many team teaching projects has not been released for publication.

Today, as evidenced by its geographic distribution, team teaching is a national issue. The national expansion of team teaching has not been uniform in character. The hottest areas or areas of greatest concentration are in southern California, Colorado, northern Illinois, Wisconsin, Michigan, suburban New York City and southern New England.[10]

Most of the participating schools in the areas of greatest interest have been influenced to some extent by neighboring colleges and universities. Harvard University's School and University Program for Research and Development (SUPRAD) has been sponsoring team teaching projects in the New England

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[9]Harold D. Drummond, "Team Teaching; An Assessment", Educational Leadership, XIX (February 1961), 160-165.

[10]"Critical Look at Team Teaching", The Instructor, LXXI (October 1961), 39.

area.[11] The Lexington, Massachusetts, project was the first of eleven experiments sponsored by SUPRAD.[12] The Midwest Administration Center of the University of Chicago has sponsored team teaching experiments in the midwestern states, particularly in northeastern Illinois. Rich Township High School, Park Forest, Illinois, and Riverside-Brookfield Township High School, Riverside, Illinois, are two schools that were advised by the University of Chicago's School Improvement Program. Five teaching teams distributed in the schools of Janesville, Madison and West Bend, Wisconsin, have cooperated with the University of Wisconsin's program.[13]

In California, the Claremont Graduate School Plan is a cooperative team teaching program. Many schools in the area are receiving assistance and encouragement from the Claremont Plan. In particular, the Claremont Plan consists of teaching teams of four to six teachers and 125 to 175 students. The team includes a team leader and a teaching aide. Six teams, two at Azusa High School, two at Fullerton Union High School, one each at Upland and Palm Springs High Schools, are cooperating with this

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[11]Robert H. Anderson, "Team Teaching in Action", The Nations' Schools, LXV (May 1960), 65-66.

[12]Ibid.

[13]Ibid.

program.[14] Besides providing advice, the Claremont Graduate School has conducted seminars for teachers participating in team teaching programs.[15]

Two well-known team teaching projects involved several junior and senior high schools. Jefferson County, Colorado, District R-1, has experimented in seven high schools, involving three thousand students and fifty teachers. This study was conducted over a period of three years (1957-1960). Almost every area of the curriculum was involved at one or more of the schools. The structure of the teams and the numbers of members on them were varied. For example

School A - American history classes of 57 were taught by two teachers.

School B - Three persons, two teachers and an aide, taught three classes of 76, 77 and 78 students in typing.

School C - English classes of 110 and 87 were taught by four team members.

These projects were conducted in cooperation with the

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[14]Harris A. Taylor, "Claremont Graduate School Program for Team Teaching", The High School Journal, XLIII (February 1960), 277-282.

[15]Dorsey Baynham, "Selected Staff Utilization Projects in California, Georgia, Colorado, Illinois, Michigan and New York", NASSP. Bulletin, XLVI (January 1962), 14-98.

University of Denver.[16]

San Diego, California, public schools conducted a two-year (1958 and 1959) experiment in the utilization of staff in the secondary school. Three junior high schools and two senior high schools in San Diego participated in this program. Team teaching studies were carried out in boys' and girls' physical education, English, United States history, mathematics-science and business education. A total of thirteen teams with twenty-two teachers was involved in this experiment.[17]

These team teaching programs illustrate the breadth and depth to which this method of instruction has developed.

Thus, team teaching, although old in principle, has developed a new and vital status in education.

Description and Terminology

In order to discuss team teaching and its various aspects intelligently, certain related terms must be defined.

Team teaching is a method of instruction in which two or more persons share the responsibility for the instruction and

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[16]"An Experimental Study of the Utilization of the Staff in Education, Jefferson County School District R-1, Lakewood, Colorado".

[17]Lee L. Bloomenshine and T. Malcolm Brown, "San Diego, California, Conducts Two-Year Experiment with Team Teaching", NASSP. Bulletin, XLV (January 1961), 146-166.

evaluation of one group of students.

A teaching team is a group of two or more persons assigned to the same students at the same time for the purpose of instruction and evaluation in one subject or a combination of subjects.[18]

A team leader is the person designated as the leader or chairman of the teaching team. Usually, he has more experience, training and leadership ability than the other members.

Terms which parallel this title of team leader are:

Professional-in-charge, teacher specialist and master teacher. The duties of the team leader, etc., vary from team to team. These persons usually possess the greatest amount of the responsibility for the instruction team.

A cooperative teacher is a certificated teacher who shares partial or equal responsibility of the instructional planning and presentation. General teacher, associate teacher, professional teacher and sometimes simply team teacher, are terms pertaining to this type of teaching position.

Paraprofessional, teaching aide and general aide are uncertificated persons with or without a college degree, but with

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[18]"An Experimental Study of the Utilization of the Staff in Education, Jefferson County School District R-1, Lakewood, Colorado".

a background in the subject or subjects being taught.

A clerk is an uncertificated person who is stenographically skilled.[19]

Several other pertinent terms, not defined now, will be identified and defined as they appear in this section.

Various forms of team teaching have been employed in the elementary schools. The organization of team teaching at the elementary level differs from the secondary level. The basic reason for this difference is the graded structure of the elementary school. The students are usually assigned to one teacher at one grade level for at least one semester. The assigned teacher is usually responsible for the instruction of all the subjects. Therefore, team teaching at this level is usually fashioned around the modification of this traditional organization.

Although it was impossible to describe all the various manifestations of team teaching in the elementary school, Brownell and Taylor[20] listed three theoretical structures of this method.

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[19]"An Experimental Study of the Utilization of the Staff in Education, Jefferson County School District R-1, Lakewood, Colorado."

[20]John A. Brownell and Harris A. Taylor, "Theoretical Perspectives for Teaching Teams", Phi Delta Kappan, XLIII (January 1962), 150-157.

Type I. Team teaching is carried out by two or more teachers at one grade level. The student group is taught one or several subjects by this team. The "core" curriculum idea would fall in this category.[21]

Type II. All or several grades at the elementary level are grouped together and taught by a teaching team. The team is responsible for the instruction of all or only one subject. The teaching of one subject by a team seems more practical than the instruction of all of them.[22]

Type III. Two grades of students are taught by a teaching team. The instruction pertains to one or more of the subjects presented at these levels. This form is actually a specific variety of Type II.[23]

The variety and organization of personnel used in the instruction of the previously mentioned team teaching methods is unlimited. Typically, the team consists of two or more persons. A team leader heads the group, supported by one or more cooperative teachers and possibly a teaching aide. The Norwalk

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[21]John A. Brownell and Harris A. Taylor, "Theoretical Perspectives for Teaching Teams", Phi Delta Kappan, XLIII (January 1962), 150-157.

[22]Ibid.

[23]Ibid.

Elementary School Plan, Norwalk, Connecticut, employed a three-member team. A team leader, cooperative teacher and a teaching aide, taught three classes of 69 to 85 students.[24]

The organization of teaching teams at the secondary level, particularly senior high school, is extremely varied. The structure of the teaching teams seems to fall into two basic divisions, horizontal and vertical stratification.

Horizontal team teaching is the term used to define teaching within one grade level. Vertical team teaching is characterized by teaching at two or more grade levels. Team teaching of a Sophomore course constitutes a horizontal teaching group, whereas team teaching of Sophomore and Junior courses within one team structure constritutes a vertical teaching group.

These organizational structures can be either intra-discipline or inter-discipline. Intra-discipline signifies teaching within one subject area, such as English. The teaching of two or more different subjects with one group of team members is known as inter-discipline team teaching.

Mattoom High School, Mattoon, Illinois, had intra-discipline team teaching in Sophomore English. The team consisted of three members, cooperative teachers and three Sophomore

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[24]R. H. Anderson, "Team Teaching in Action", The Nations Schools, LXV (May 1960), 62-65.

English classes.[25] West Chester Junior High School, West Chester, Pennsylvania, had a ninth grade inter-discipline team teaching program which included the instruction of history, mathematics, English, geography and science. The West Chester School was designed and constructed specifically for team teaching.[26]

Urbana Senior High School, Urbana, Illinois, had a team teaching program which had a two-member team instructing Junior and Senior English. One teacher met with the Seniors three days a week and with the Juniors two days a week to study grammar and writing. The second teacher taught English literature to the Juniors and American literature to the Seniors.[27]

A team teaching program usually centers around three basic units, large-group instruction, small-group seminars and individual study. Wayland High School, Wayland, Massachusetts, used four basic units for its English team teaching project. The large-group consisted of about one hundred students, a medium size group of about thirty students, seminar

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[25]H. A. Clawson, "English and Science Studies in Mattoon Senior High School", NASSP. Bulletin, XLIV (January 1960), 257-261.

[26]G. Arthur Stetson and James P. Harrison, "Junior High School Designed for Team Teaching", NASSP. Bulletin, CXL (May 1960), 38-42.

[27]H. A. Clawson, "English and Science Studies in Mattoon Senior High School", NASSP. Bulletin, XLIV (January 1960), 257.

groups of twelve to fifteen students and individual study.[28]

The large-group instruction phase varies in size, presentation and scheduling. The size of the group ranges from a double class, fifty to sixty students, to over two hundred students.

Newton High School, Newtonville, Massachusetts, had a team teaching class in plane geometry which consisted of sixty students and English, history and biology team classes of one hundred and twenty students.[29] On the other extreme, Fremont High School, Sunnydale, California, combined three team teaching groups, 240 students, together for large-group presentation.[30] Many varieties of large-group instruction fall within these extremes.

The responsibility for the presentation of instruction to large groups is usually assumed by all of the team members. The instruction is conducted by lecture, demonstration or some combination of these two. The lecturer usually has some audio-visual aides which he may employ.

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[28]Paul M. Ford, "Different Day for the English Teacher", English Journal, L (May 1961), 334-337.

[29]Henry Bissex, "Second Stage: Revision, Extension of Newton Plan Studies", NASSP. Bulletin, XLIII (January 1959), 106-119.

[30]Vernon Cordry, "More Flexible Schedule at Fremont", Cal. Journal of Secondary Education, XXXV (February 1960), 114-116.

Besides the blackboard, the lecturer uses a sound system, slide, movie and overhead projectors. Ridgewood High School, Norridge, Illinois, used overhead projectors almost to the exclusion of blackboards--quite appropriate for their four large-group instruction areas. Each of these areas was equipped with its own public address system.[31]

The large-group instruction of Senior English at Evanston High School, Evanston, Illinois, was accomplished by closed-circuit television. Instead of the large lecture area, the lectures and demonstrations were transmitted to classroom television receivers. One teacher lectured to his group while his lecture was viewed by three other classes in their own classroom.[32]

The scheduling of large groups is usually the same as for regular class periods; that is, forty to fifty-five minutes. The students within a team subject are all assigned to the same period. Riverside-Brookfield Township High School, Riverside, Illinois, had team teaching in Junior English and American history, in which the students were assigned to three and

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[31]Eugene R. Howard and Melvin P. Heller, "Physical Facilities at Ridgewood High School, Norridge, Illinois", October, 1961.

[32]Wanda B. Mitchell, "Evanston, Illinois, Township High School Expands Use of Closed-Circuit Television in 1957-1958", NASSP. Bulletin, XLIII (January 1959), 75-78.

two teachers respectively during the same hour. The three English teachers and the two American history teachers could thus bring their groups together for a large-group section.

Several team teaching projects have double periods set aside for large-group instruction. The double period is usually composed of a regular class period and a period for individual study or study hall.

Ridgewood High School, Norridge, Illinois, had scheduled its classes on twenty minute modules. The large-group met for forty minutes two days a week. These large-group instruction classes cut across the traditional school period schedule.[33]

Small-group seminars usually have about twelve to sixteen students. J. Lloyd Trump suggested fifteen as the optimum number of students in any one seminar group.[34] The seminar group may be headed by a teacher or a student chariman.

The primary purpose of the seminar group is to discuss the material which has been presented for the students during

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[33]Eugene R. Howard and James E. Smith, "Flexible Scheduling at Ridgewood High School, Norridge, Illinois, 1961."

[34]J. Lloyd Trump and Dorsey Baynham, Focus on Change, Guide to Better Schools, Rand McNally, Chicago, 24.

the large-group instruction. These seminars can involve review or enrichment depending upon the ability of the group. Twenty to thirty percent of the class time is considered adequate time for seminar groups.[35]

Facilities for seminar groups are not always adequate; therefore, many teaching teams divide the seminar group along class lines, i.e., twenty-five to thirty students. The function of this group is the same as for the smaller seminars, but in this case the group is headed by a teacher.

Individual study within a team teaching framework can be very diversified. The student usually has access to special work and study areas. The new language laboratories represent one of these areas. Laboratories in the physical and biological sciences provide another area for specific study and work. Libraries within a school represent the most frequented facilities for individual study.

Wayland High School, Wayland, Massachusetts, has resource centers where students are allotted one period a week per class for individual study.[36] Ridgewood High School, Norridge,

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[35]J. Lloyd Trump and Dorsey Baynham, Focus on Change, Guide to Better Schools, Rand McNally, Chicago, 24.

[36]Paul M. Ford, "Different Day for the English Teacher", The English Journal, L (May 1961), 334-337.

Illinois, has elaborate resource centers for science and hamanities, plus laboratories for science, foreign language and reading. These areas are equipped especially for individual study with small tables and booths to provide privacy. Teachers are available to aid the students having difficulty.[37]

Much has been written about the forms of team teaching and its basic units, but little has been presented about the internal structure of teaching teams. The writer feels that teaching teams can be divided into two fundamental categories: heirarchical and cooperative teaching teams.

The hierarchical teaching team is easy to recognize since one of its members is considered to be the chairman. The title for this position varies, but the responsibilities of the chairman appear to be the same. These persons are called teacher specialists, team leaders or master teachers. The team leader is considered to be a teacher superior to the other teachers in the team. His basic function usually is to give lectures to large groups and supervise the activities of the teaching members.

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[37]Eugene R. Howard and Melvin P. Heller, "Physical Facilities at Ridgewood High School, Norridge, Illinois, October, 1961."

Jefferson County, Colorado, District R-1, employed four-member teams. The team consisted of a team leader, two cooperative teachers and a teaching aide, who was usually a clerk.[38] Glenbrook High School, Northbrook, Illinois, had a two-member teaching team in general science which consisted of a certified teacher and a paraprofessional.[39] This was not a true hierarchical team, but it is an indication of the numerous varieties possible in this structure.

Cooperative team teaching is, as its name implies, a framework based upon equality of all the team members. The responsibility for the planning and presentation rest equally on all its members. The leadership within these teams is present, but in a more subtle manner. The leadership changes hands as various phases of the curriculum are put into operation.

The greatest percentage of teaching teams appears to fall into the cooperative framework. Various terms represent the

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[38]Robert H. Johnson and M. Delbert Lobb, "Jefferson County, Colorado, Completes Three-Year Study of Staffing, Changing Class Size, Programming and Scheduling", NASSP. Bulletin, XLV (January 1961), 57-79.

[39]Wesley G. Bovinet, "Glenbrook Reports on Four Experiments on Utilization of Staff", NASSP. Bulletin, XLIV (January 1960), 244-253.

same idea. For example, Rich Township High School, Park Forest, Illinois' team teaching plan in American history employs what is called associate team teaching.[40]

A colleague or peer team was used at the University of Chicago Laboratory School in the 1959-1960 school year.[41] Fifty students were taught algebra, earth science and geography b a three-member team. The three teachers not only had equal responsibility but their selection was based on similarities of age, sex, experience and marital status.[42]

The advantages and disadvantages of the use of hierarchical or cooperative teaching teams, the use of large-group instruction, seminars or individual study, the use of vertical or horizontal teaching structures and the use of intra-discipline (departmental) or inter-discipline team teaching depends upon the team teaching program, the subjects to be taught and the available finances and facilities. The advocation of any particular team organization is impossible until all the pertinent factors are considered. Each team teaching plan should be fashioned according to desired needs, goals and physical

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[40]Will Hermeyer and Jean B. McGrew, "Big Ideas for Big Classes", School Review, LXVIII (Autumn 1960), 308-317.

[41]Robert Hanvey and Morton S. Tenenberg, "University of Chicago Laboratory School, Chicago, Evaluates Team Teaching", NASSP. Bulletin, XLV (January 1961), 189-197.

[42]Ibid.

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Critical Literary Review

The literature on team teaching is very recent and comparatively sparse. The Education Index up to the date of June, 1962, lists approximately one hundred articles on team teaching.

Most of these articles appear in the issues of the Bulletin, National Association of Secondary-School Principals, Washington, D. C.. The NASSP devotes its January issues to staff utilization with major emphasis on team teaching.

"New Horizons in Staff Utilization," NASSP Bulletin, XLII, January, 1958, presented the first descriptions of team teaching projects. J. Lloyd Trump's, "A Look Ahead in Secondary Education," pages 5-15 in this issue was an introductory article attempting to give a picture of what the secondary school of tomorrow might be like, Part of this article pertained to team teaching.

"Exploring Improved Teaching Patterns: Second Report on Staff Utilization," NASSP Bulletin, XLIII, January, 1959, continued the presentation of team teaching projects. In the same issue, Newton High School, Newtonville, Massachusetts', team teaching projects were presented in Henry Bissex's, "Second Stage: Revision, Extension of Newton Plan Studies," pages 106-119.

Mattoon Senior High School, Mattoon, Illinois; Jefferson County Colorado, District R-1; Evanston Township High School, Evanston, Illinois; University of Chicago Laboratory School, Chicago, Illinois; Syosset High School, Syosset, New York, and Glenbrook High School, Northbrook, Illinois, were also found in the January, 1959, issue.

"Progressing Toward Better Schools," NASSP Bulletin, XLIV, January, 1960, and "Seeking Improved Learning Opportunities," NASSP Bulletin, XLV, January, 1961, devoted an increasing amount of space to team teaching. In addition to progress reports of several projects presented in 1959, new team teaching programs were reported at Snyder Public Schools, Snyder, Texas; Hurricane High School, Hurricane, Utah; San Diego Public Schools, San Diego, California; Taylorville High School, Taylorville, Illinois; Arlington Township High School, Cicero, Illinois, and Urbana Senior High School, Urbana, Illinois.

An attempt to reach some conclusions about staff utilization, including team teaching, was presented in Beryl R. Dillman's, "An Appraisal of NASSP's Staff Utilization Study at the Close of Its First Two Years," NASSP Bulletin, XLIV, January, 1960, pages 13-18.

In J. Lloyd Trump's, "Brief History and Recommendations of the Commission on the Experimental Study of Staff Utiliza-

tion in the Secondary School, "NASSP Bulletin, XLV, January, 1961, pages 275 to 281, an interesting review of the experiment on staff utilization was presented.

"Focus on Change," NASSP Bulletin, XLVI, January, 1962, had the most extensive report of team teaching published at the present time. This issue contained articles describing team teaching projects at Ridgewood High School, Norridge, Illinois; East Side District Schools, San Jose, California; Easton Pennsylvania Schools; Johnson High School, St. Paul, Minnesota; Winfield High School, Winfield, Kansas; Verdugo Hills High School, Tujunga, California and Muskegon Senior High School, Muskegon, Michigan.

Melvin P. Heller and Elizabeth Belford's, "Team Teaching and Staff Utilization in Ridgewood High School," presented the underlying theory of one of the most extensive team teaching projects, Ridgewood High School, Norridge, Illinois.

Review of a six-state survey of team teaching representing the most extensive study of team teaching projects, was presented in Ira J. Singer's, "Survey of Staff Utilization Practices in Six States," NASSP Bulletin, XLVI, January, 1962, pages 1 to 13, and Dorsey Baynham's, "Selected Staff Utilization Projects in California, Georgia, Colorado, Illinois, Michigan and New York," NASSP Bulletin, XLVI, January, 1962, pages 14 to 98.

The National Association of Secondary-School Principals Commission on the Experimental Study of the Utilization of the Staff in the Secondary School has sponsored several other publications. J. Lloyd Trump, Director of the NASSP Commission, has been author or co-author of these books and pamphlets. These publications are as follows:

Trump, J. Lloyd, Images of the Future, Commission on the Experimental Study of the Utilization of the Staff in the Secondary School, 1960.

-----, New Horizons for Secondary School Teachers, 1957.

-----, New Directions to Quality Education: The Secondary School Tomorrow, 1960.

-----, and Baynham, Dorsey, Focus on Change, Guide to Better Schools, Rand McNally, 1961.

Images of the Future attempted to give a picture of what the secondary school of the future might be like by combining many of the significant trends that are observable today. Focus on Change presented a guide which is a base for all aspects of staff change. This book covered schedule modification, group organization and educational facilities. In the appendix was a list of schools undertaking projects and an outline of suggested staff utilization studies. Both of these books gave a detailed explanation of various phases of staff utilization with an emphasis on team teaching.

New Direction to Quality Education and New Horizons for

Secondary School Teachers are pamphlets giving only a brief outline of the major directions in staff utilization. Various aspects of the problem of staff utilization in the secondary school are discussed. Possible experimental studies are listed. These two publications are not of much value for detail, but they do give an overview of the entire staff utilization study.

The most extensive explanations of team teaching were obtained from personal correspondence with several schools. These schools have published well-organized reports of their team teaching programs. An Experimental Study of the Utilization of the Staff in Education, Jefferson County, Colorado, District R-1, Lakewood, Colorado, is a report of a three-year project (1957-1960) in team teaching, schedule modification and class size study.

John Antel, et.al., Team Teaching, J. Sterling Morton High School, Illinois' Staff Utilization Study, thoroughly explained the Morton team teaching project in American history and American literature. This publication has a complete syllabus of this teaching program.

Evanston Township High School, Evanston, Illinois, team teaching projects are well-publicized, but more detail can be obtained from the mimeographed sheets of course description. The writer received considerable information from their English Project, Seniors to Study Humanities, Biology Project, Social

Studies Large Class Projects, Large Class Projects in General Mathematics and Plane Geometry Project.

C. D. Henry's, Staff Utilization Project, Summary Report, Snyder Public Schools, Snyder, Texas, January, 1960, presented the evolution, scope, design and organization of Snyder's team teaching projects. Included in this report are remarks by the participating members and C. D. Henry, Superintendent.

San Diego Public Schools' staff utilization project under the guidance of Lee L. Bloomenshine, Assistant Superintendent in Charge of Secondary Schools, is reported in Experimental Project in Staff Utilization, San Diego City Schools, San Diego, California, June, 1960. This was a report of two years of experimentation (1958-1960) which employed the team approach.

The Ridgewood High School, Norridge, Illinois, team program was supplemented by flexible scheduling and a new physical plant. These two topics are thoroughly discussed in Eugene R. Howard and Melvin P. Heller's, Physical Facilities at Ridgewood High School, Norridge, Illinois, October, 1961, and Eugene R. Howard and James E. Smith's, Flexible Scheduling at Ridgewood High School, Norridge, Illinois, 1961. These reports are available from Ridgewood High School.

Most of the published articles on team teaching are general in nature. Very little detail about the material being taught in these team teaching projects can be obtained.

The articles present incomplete evaluations and are inconclusive. The evaluations do not give much indication of the success or failure of team teaching. The evaluation tends to be too teacher-centered and subjective. Many experimenters feel that the success of a project is determined by the enthusiasm of the participating teachers to continue with the project.

The writer feels that many articles on team teaching projects are not well-planned. Teachers and administrators of the schools presenting articles for publication have been more concerned with determining favorable rather than objective results.

A more effective utilization of the professional staff has been one of the true selling points. Faculty morale among team members is usually very high. Teachers have felt that their creativity was stimulated by the many innovations possible.

The inability of the team members to get along with each other has presented obstacles in certain instances. This is most manifest when the master teacher is senior and inflexible and the other team members are young, aggressive and ambitious. Obviously, great care must be exercised in the selection of teaching personnel.

The more effective use of professional time has resulted in better preparation and presentation. The administrators and teachers feel that professional growth of the teacher has

been influenced by team teaching. Most team members wish to continue in team teaching.

From the student frame of reference, the results have not shown anything decidedly conclusive. The student morale usually appears to be high. The student usually has had more time for independent work and study due to a more flexible organization of schedules.

Student achievement has been about equal to the achievement within a traditional classroom framework. True success or failure of the team teaching method has not been represented by standard test results. Most participating teachers have felt that the students are achieving more in terms of the intangible aspects of education.

Team teaching, as in any method, does present some problems. Team members have felt that some students do not adapt themselves to large groups very readily. In some instances, student individuality and teacher-student rapport have declined.

Some of the main criticisms of team teaching projects have been directed toward unimaginative administrators and school boards. Due to inadequate facilities, some teachers have found team teaching more demanding of their time than regular classroom teaching situations. Poorly equipped auditoriums, lunchrooms and large study halls have been used for

large-group presentation. Some administrators have attempted to be conservative with finances necessary for the purchase of additional equipment.

The scheduling of teachers, in some instances, has prevented the team members from meeting during a common free period. This diminishes the possibilities for evaluation and adjustment of team teaching projects by the teaching group. In small school districts the turnover of teaching personnel has hindered the team teaching projects.

In schools where the previously mentioned disadvantages have been met by foresighted administrators, team teaching appears to be progressing satisfactorily.

Most educational innovations follow a three-stage cycle of exploration and initial development, expansion and critical evaluation. Team teaching is presently on the borderline between initial development and expansion. The educators should be prepared to evaluate closely this teaching approach from various standpoints.

CHAPTER II

OVERVIEW OF THE PROBLEM

Initial Assumptions and Hypotheses

The teaching of chemistry in the secondary school usually employs the traditional classroom structure. One teacher is responsible for about twenty-four students in each class. On the average, the students have three lecture and two laboratory sessions each week. This project is an analysis of team teaching in chemistry as practiced at Riverside-Brookfield Township High School, Riverside, Illinois, where the students formerly had four lectures and one laboratory session each week. The students were permitted only fifty-five minutes of laboratory experience every week. The chemistry course tended to be considerably teacher-centered. Student individuality was not emphasized and, in fact, appeared to be stifled.

In the spring of 1959, the three chemistry teachers with encouragement from the superintendent, embarked upon the organization of a team teaching project in chemistry. In conjunction with the organizational planning, steps were being taken by the administration to build facilities for the team project. The team membership was reduced to two teachers due to reorganization

within the school.

The primary objective of the project was to improve the quality of instruction by means of a team approach extending the use of the teachers to a larger group of students. At the same time, more student-centered activities were put into the curriculum

The basic assumptions were:

1. Students would gain added satisfaction of learning through greater responsibility for their learning and discipline.
2. Students could secure scientific knowledge through various means and at the students' own pace.

A secondary assumption was that through the team teaching approach better staff utilization would be realized. Teachers would be able to concentrate on topics of greatest interest or specialization. Better planning by the team members, due to more free time, would result in better instructional presentations. Released time would result in more individual attention for the students.

The primary purpose of this study was to test the hypothesis that the team teaching approach to the instruction of chemistry would result in at least an equally effective learning situation as the conventional classroom organization.

The study was planned to test the effectiveness of team

teaching in comparison to traditional teaching methods.

Sources of Data

The testing of the hypothesis entailed the collection, interpretation and comparison of data. This section will present the methods used in collecting the data, describing the tools and techniques employed.

The study, in part, consisted of comparisons between an experimental group and a control group. The two groups were taught by different methods, but by the same two teachers.

The control group consisted of seven regular size chemistry classes totaling 166 students who were taught chemistry by the traditional method. The seven classes consisted of five classes of heterogeneously grouped Juniors and Seniors, and two classes of homogeneously grouped Sophomores. These students received their chemistry instruction during the 1960-1961 school year. For this comparative study, the classes of the control group were combined into one heterogeneous group.

The experimental group was composed of four double classes totaling 185 students who received instruction by the team approach. The students in these classes were heterogeneously grouped Sophomores, Juniors and Seniors. The students in the team teaching classes received their chemistry intruction during the 1961-1962 school year.

Membership in the two groups (control and experimental) were studied for purposes of "equation" by the administration of initial intelligence and achievement tests.

Intelligence Tests

Prior to entry into high school the students were examined for intelligence and aptitude, employing the "California Short-Form Test of Mental Maturity, Junior High School Level," California Test Bureau. This test was constructed for administration during one class period. The test yields a normal distribution of intelligence quotients, has a mean of 100 and a standard deviation of 16. The coefficient of reliability for the total, which contains segments of language and nonlanguage items is .95. The intelligence quotient is referred to as the "Maturation Rate", abbreviated MR.

The control and experimental groups' intelligence was compared using the "California Test". In order to compare the difference of intelligence of the two groups the MR's were compared. The mean MR's of the groups were tested for variance using the Fisher "t" test for difference between uncorrelated means.

$$t = \frac{M_1 - M_2}{\sqrt{\left(\frac{\Sigma x_1^2 + \Sigma x_2^2}{N_1 + N_2 - 2}\right)\left(\frac{N_1 + N_2}{N_1 N_2}\right)}}$$

M_1 - Mean of experimental group

M_2 - Mean of control group

Σx_1^2 - Sum of the squared deviations of experimental group

Σx_2^2 - Sum of the squared deviations of the control group

N_1 - Population of experimental group

N_2 - Population of control group

$N_1 + N_2 - 2$ - Degrees of freedom

Achievement Test

The achievement of the two groups were determined by using the "Co-operative Chemistry Test," Form Z, Educational Testing Service, 1950. This was a two-part test of eighty-one multiple choice items. The first part of the test covered basic chemistry facts and principles. The second part tested for knowledge of laboratory techniques, chemistry principles and quantitative applications. The time limit was forty minutes, twenty-five minutes for part one and fifteen minutes for part two.

The chemistry test was administered as a pre-test and at the conclusion of one year of chemistry. The mean raw score of the groups were compared for variance using the Fisher "t" test of difference between uncorrelated means. The raw scores were determined by machine scoring using the formula:

$$\text{Raw Score} = \text{Right} - \frac{\text{Wrong}}{4}$$

In addition, an item analysis of the test was conducted to determine the relative achievement on the various units of instruction. Comparison of the unit and total correct responses was made.

Student Questionnaire

An achievement test cannot show student interest, appreciations and attitudes; therefore, some techniques were necessary to determine the degree to which the students were influenced by the team teaching approach.

A student questionnaire was devised after a San Diego City School questionnaire[1] to determine the reactions of the experimental group students toward the team teaching project.

The students were asked to answer twenty items each with one of three choices. Seventeen items were phrased in terms of opportunities for various learning experiences. The students were asked to indicate whether they felt there were more, less, or about the same opportunities for these experiences in the team teaching class as in their regular classes. Three

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[1]Lee L. Bloomenshine, "San Diego, California, Conducts Two-Year Experiment with Team Teaching", NASSP. Bulletin, XLI (January 1961), 163.

additional items were used to determine the students' attitudes toward "being in a large class," "having more than one teacher in the classroom," and "having different teachers for different activities." The students were asked to indicate whether they liked, disliked or were indifferent to these items.

In treating the responses of students in the questionnaire, it should be kept in mind that their high evaluations may have been based on superior personal characteristics of their assigned teachers and that lower evaluations may have been attributed to educationally undesirable personal characteristics rather than the organization and method of team teaching.

Personal Observations

An indication of the students' interest was difficult to determine by any test or questionnaire. To determine the student interest a fifteen day period, May 17 to June 7, 1962, was set aside for observation. During the three weeks a count was made of the number of students who came into the chemistry laboratory and library during their free periods and after school. This count was used as an evidence of student interest.

An analysis of the academic years 1960-1961 and 1961-1962 was made to determine the time allotment for various phases of the chemistry course. Since more student-centered activities were desired, the analysis was conducted to compare the time available for these activities.

Teacher Interview

The two teachers who participated in this project reviewed the year's work in team teaching by considering items that were closely related to the student questionnaire. The teachers compared the opportunities to provide certain teaching-learning conditions in the project classes with the classes of the previous year. The comparison of times for lesson planning and preparation, employment of new techniques and classroom control were three items considered.

The results of this team teaching project were weighed as objectively as possible. Most of the data was tested for covariance in order to determine whether there were significant differences. In establishing confidence limits for the interpretation of the data, the five percent level was used to represent a significant difference, the one percent level to represent a very significant difference.

The variables involved in this study were numerous, but the writer has attempted to reduce them to a minimum. Some of the variables cannot be eliminated. The influence of these variables upon the outcome of this project will be discussed in the conclusion.

CHAPTER III

BACKGROUND OF THE TEAM TEACHING PROJECT

In the summer of 1961, the two members of the chemistry team met daily for six weeks to consolidate all of the accumulated materials and formulated the course of study for the team teaching project. This course of study was consistent with the school's science curriculum. The various phases of this curriculum and the supplementary materials for this project are presented in this chapter.

Objectives

The general objectives were expressed in terms of the kind of behavior to be developed in the student as suggested by Tyler.[1] The following objectives were stated in terms of generalized patterns of behavior.

1. To grow in the functional understanding of facts, including knowledge about great men of science.
2. To grow in the functional understanding of concepts, principles and theories of chemistry.

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[1]Ralph W. Tyler, Basic Principles of Curriculum and Instruction, University of Chicago Press, Chicago, Illinois (1950), 30.

3. To develop the ability to think critically; i.e., to observe systematically and to make evaluations and generalizations from the data obtained.
4. To develop a scientific attitude as shown by the ability to suspend judgment until facts are secured and to revise erroneous conclusions.
5. To develop effective skills in the manipulation of laboratory equipment.
6. To develop an appreciation of the contributions of chemistry.
7. To acquire or extend an interest of science.
8. To develop an awareness of the sources of chemical information.
9. To acquire added satisfaction in learning through more independent responsibility for learning and discipline.
10. To develop increased creativity and better habits of intellectual inquiry and study.

The general objectives did not pertain to any specific areas of the curriculum; therefore, specific objectives had to be stated. Many of these objectives pertained to facts, skills, concepts and principles studied and utilized in several units of instruction, but were expressed in the unit in which

they first appeared.

Unit I. Introduction

1. To understand the position of chemistry in relation to the other sciences.
2. To know the basic physical concepts applicable to chemistry, especially the forms of matter and energy.
3. To learn the difference between elements, compounds and mixtures, physical and chemical change.
4. To develop a working knowledge of the scientific method.
5. To become proficient in the use of the metric system.
6. To learn the basic skills and tools of experimentation.

Unit II. The Structure of Matter

1. To understand and appreciate the modern atomic theory, atomic structure, the periodic law and the periodic table.
2. To learn the basic fundamentals of valence and bonding.
3. To develop an understanding of molecules, their formulas and nomenclature.
4. To learn to write correct word and formula equations.

Unit III. Theory of Solutions

1. To understand the various aspects of water and its properties.
2. To learn the types of solutions and their concentrations.
3. To develop a working knowledge of ionization, dissociation and crystallization.
4. To understand the properties and differences of acids, bases and salts.
5. To understand the basic fundamentals of chemical and ionic equilibria.
6. To acquire an understanding of colloids and their many uses.

Unit IV. Chemical Calculations

1. To acquire a working knowledge of
   a. Atomic weights
   b. Formular weights
   c. Molecular weights
   d. Percentage composition
2. To develop an understanding of the mole concept.
3. To learn to solve weight-weight, volume-volume, and weight-volume problems.
4. To develop a working knowledge of the gas laws.

5. To acquire a fundamental understanding of the kinetic-molecular theory.

Unit V. The Behavior of Matter

1. To understand and differentiate between the various types of chemical change.
2. To develop a working knowledge of oxidation-reduction equations.
3. To acquire the skill of writing oxidation-reduction equations.
4. To develop a basic understanding and appreciation of electro-chemistry and the activity of elements.

Unit VI. Non-Metals

1. To study and know the basic physical and chemical properties of the common non-metals.
2. To acquire some knowledge of the family phenomenon of elements.
3. To learn the basic preparation methods of non-metals.

Unit VII. Metals

1. To acquire an understanding of the families of metals.
2. To learn the processes for preparation of metals.
3. To appreciate the application of metals in everyday living.

Unit VIII. Nuclear Chemistry

1. To learn the basic fundamentals of natural and artificial radioactivity.
2. To know the basic particles in the nucleus.
3. To develop a thorough understanding of the power contained in nuclear fission and fusion.
4. To acquire an appreciation of the military and civilian uses of nuclear energy.
5. To learn to write correct nuclear equations.

Unit IX. Organic Chemistry

1. To understand the difference between inorganic and organic chemistry.
2. To learn the common organic groups, their structural formulas and nomenclature.
3. To develop an appreciation of the industrial and commercial applications of organic chemistry.

Unit X. Qualitative Analysis

1. To develop working knowledge of cation and anion analysis.
2. To determine the constituents of an unknown sample using all the acquired knowledge of chemistry.

The students were not given these objectives. Instead, they were given an outline for each unit which contained a

listing of all of the pertinent facts, concepts and principles they were expected to know. General and specific objectives represented the basic guides for the organization of the curriculum. Evaluation of the program was closely related to these objectives.

Curriculum Design and Methods

The instructional organization of the chemistry course was divided into ten basic units. The sequence of topics was developed in accordance with the suggested chemistry outline of Koelsche.[2] The outline that follows presents the ten units and their basic sub-divisions.

Unit I. Introduction

A. Position of chemistry in relation to other sciences.

B. Brief review of physical concepts applicable to chemistry.

C. Measurements in chemistry.

D. Nature of matter and energy.

E. Classification of matter.

Unit II. The Structure of Matter

A. Atomic theory and structure.

B. Periodic Law and Table.

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[2]Charles L. Koelsche, "The Course in Chemistry," NASSP. Bulletin, XLV (December 1960), 111-126.

C. Chemical bond and valence.

D. Molecules.

E. Chemical notation.

Unit III. Theory of Solutions

A. Water.

B. Solutions.

C. Ionization.

D. Acids, bases and salts.

E. Chemical and ionic equilibria.

F. Colloids.

Unit IV. Chemical Calculations

A. Atomic, formula and molecular weights.

B. Percentage composition and empirical formulas.

C. Mole concept - concentration of solutions.

D. Weight and volume problems.

E. Gas Laws.

Unit V. Behavior of Matter

A. Chemical change and energy of reaction.

B. Oxidation-reduction reactions.

C. Oxidation-reduction equations.

D. Electro-chemistry.

Unit VI. Non-Metals

A. General characteristics.

B. Oxygen and Hydrogen.

C. Sulfur and its oxides.

D. Halogen family.

E. The atmosphere and the Nitrogen family.

F. Silicon and Boron.

Unit VII. Metals

A. General background - geology and mining.

B. Alkali metals.

C. Alkaline-earth metals.

D. Light metals.

E. Heavy metals.

Unit VIII. Nuclear Chemistry

A. Nucleonics.

B. Radioactivity.

C. Detection and measurements of radioactivity.

D. Mass and energy - Einstein's equation.

E. Nuclear energy and war.

F. Nuclear energy and peace.

Unit IX. Organic Chemistry.

A. Common organic compounds.

B. Petroleum.

C. Hydrocarbon substitution and addition products.

D. Development of the organic chemistry industry.

Unit X. Qualitative Analysis

A. Fields of chemical analysis.

B. Review of qualitative analysis methods.

C. Chromatography.

The subject matter covered in each unit was organized in sequence of priority. Principles and concepts deserved and received more emphasis than the many facts. Some topics presented in the unit outline were left for student exploration and study.

Every student in chemistry was presented with a unit outline at the start of each unit. In addition to the topics the students were to study, the outline included a list of chemical terms. A working knowledge of these terms was necessary for a successful understanding of the unit.

Reading assignments in the regular textbook, Modern Chemistry[3], were listed in each unit outline. The same textbook was used by the experimental and the control groups. A cross-reference was included with the textbook assignments. These reference sections contained a listing of several chemistry textbooks. The main topics were cross-referenced with the pertinent pages within each textbook. This enabled a student to refer to several sources about any particular topic.

Regular and enrichment laboratory experiments were listed

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[3]Charles E. Dull, H. Clarke Metcalfe and John E. Williams, Modern Chemistry, Henry Holt and Company, New York, 1958.

at the end of each unit outline. The number of regular experiments were sufficient to insure completion by the average student. The above-average students were encouraged to do the regular experiments and as many enrichment experiments as possible. The basic tenet of the course was that students were to be permitted to work with laboratory experiences at their own pace.

The chemistry course was organized around the laboratory. Students heard lectures on the main topics of chemistry which gave them the necessary background to perform and report the experiments with little difficulty. On the average, the students work two and one half days a week in the laboratory. Often a lecture required only a portion of the class period; the remaining time was spent by the students in the laboratory. When there were no lectures or movies the students worked in the laboratory.

The students were furnished laboratory manuals for experiments. These manuals were part of the laboratory equipment; the students were not permitted to take them out of the laboratory. They were required to perform the experiments and write their laboratory reports in the laboratory. Any students who wished could come into the laboratory during their free periods or after school to work on laboratory experiments and reports.

A library-seminar room within the laboratory was available

for student use. The teachers used this room to assist students having difficulties with the topics being studied. All the chemistry students could use the library-seminar room during any period of the school day or after school. Competent students were encouraged to do special projects or experiments. The resource material in the library-seminar room was at their disposal. Special experiments were permitted providing the student understood, to the teachers' satisfaction, all the important facts about the experiment. Three special projects rooms were available for these student experiences.

Instructional Organization

The chemistry course presented was not revolutionary, but the organization of instruction was new for a high school. The course was designed for team teaching with a great emphasis on laboratory work.

Two teachers, the science department chairman and the writer, were engaged in a cooperative team teaching project during the 1961-1962 school year. Team teaching in chemistry at Riverside-Brookfield Township High School, was inaugurated in the fall of 1961.

Team teaching in chemistry was cooperative; the teachers shared the responsibility for the instruction and evaluation of four double classes. The classes ranged in size from forty-five to fifty students.

The teachers selected units from the ten instructional units. The team members did not merely divide the work between themselves. The selection of the units was based upon a set of criteria. The members chose a unit for lecturing when they felt their academic background and interest would provide the students with the most educational experiences. They were responsible for the lecturing of this unit.

The lecturing teacher was the leader for that particular unit. It was his responsibility to organize the lectures, laboratory experiences, movies and testing. This teacher also administered the tests and quizzes to the students.

The leadership for the units was not absolute; there was enough flexibility to insure a harmonious atmosphere. The lecture teacher conferred with the laboratory teacher in all matters that warranted a decision. Student make-up assignments for absentees were controlled by the lecture teacher. The student was told what work had been missed and an examination date was scheduled. The laboratory teacher was responsible for laboratory make-up work administered to the student.

One teacher selected Units III, IV, VI and VIII; whereas, the other teacher selected Units I, II, V, VII, IX and X for lecturing. The disparity in the number of units lectured by the two members was actually equalized in terms of weeks of

instruction. For example, Unit VI required six weeks for completion in contrast to the five weeks required by Units IX and X.

The lecturer was responsible for the testing of the students and the scoring of the tests. The culmination of each unit was a test and a test review.

The laboratory supervision for any unit was the responsibility of the teacher not lecturing. This teacher was responsible for the necessary special chemical supplies and equipment. When the students did not have lectures or movies they were in the laboratory. All the students in one class (forty-five to fifty students) had laboratory at the same time.

The laboratory experiences consisted of performing experiments and writing formal reports. Each student was required to submit to the laboratory teacher a report on every completed experiment. These reports consisted of object, chemical supplies, method, observation and conclusion. The laboratory teacher was responsible for the evaluation and grading of these reports.

The main responsibility of the teacher in charge of the laboratory was to assist students having difficulties with experiments. In situations where the number of students with difficulties was too great for one teacher, the lecture teacher assisted the laboratory instructor. At the start of the

school year both teachers were present in the laboratory most of the time, but as the year progressed, the need for the second teacher in the laboratory almost vanished.

On days of lectures, the laboratory was open for student use. Any student who had a free period was permitted to do laboratory experiments or special projects in the laboratory. The laboratory teacher supervised these activities while he prepared chemical reagents for succeeding experiments.

Individual assistance for students having difficulties with chemistry was the responsibility of both teachers. When the laboratory was being used the lecture teacher was available by appointment for student assistance, while on lecture and movie days the laboratory instructor assisted individuals. Assistance for students before and after school was also available, but it was not organized with any division of labor in mind.

Evaluation and grading was done cooperatively by both teachers. The lecture grade was determined from homework assignments, quizzes and tests. The laboratory grade was decided upon from a compilation of points. The points are earned by the students from laboratory reports. The two teachers evaluated the two grades and arrived at a cumulative grade for each student. Notices of failure were written cooperatively and signed by both teachers.

A general discussion of the team teaching project often implies many things which at first reading escape detection. A more specific presentation of the project should assist the reader to understand it more clearly. A discussion of a unit should serve this purpose.

Unit IX was a three-week block of work organized around the basic principles of organic chemistry. This unit embodied the study of common organic compounds, their structure and nomenclature. The homologous series of alkanes, alkenes and alkynes were studied and compared.

The background material was used as a base for the more advanced study of hydrocarbon substitution and addition products. Finally, the students studied some of the many commercial applications and products of organic chemistry.

The writer, teacher "A", was responsible for the lecturing of Unit IX. Teacher A selected this unit for lecturing because he had a good academic background of and a strong interest in organic chemistry.

The unit required four lecture sessions for the presentation of all the basic concepts and principles. Monday and Thursday of the first week were used for lectures. The two following Mondays rounded out the lecturing phase of the unit. The lectures were presented with a question-answer approach. The following questions were used to stimulate thought and

discussion.

A. Common organic compounds

1. What is a homologous series?
2. What is the difference between the saturated and unsaturated hydrocarbons?
3. How do structural formulas solve the problem of isomerism?

B. Hydrocarbon substitution and addition products

1. Can you draw the general structural formulas for the following?
   a. Halogen derivatives
   b. Alcohols
   c. Ethers
   d. Aldehydes
   e. Ketones
   f. Organic acids and esters

C. Petroleum

1. What is the origin of petroleum?
2. How are crude oils refined?
3. What is the difference between thermal and catalytic cracking?
4. What are some of the methods for improving the quality of gasoline?
5. How is knocking diminished?

D. Development of the organic chemistry industry

1. What are soaps and detergents?
2. What is saponification?
3. How can the basic foods be detected?
4. What are the differences between natural and synthetic rubber?
5. How do synthetic fibers compare with natural fibers?
6. What is polymerisation? How is it used in the plastics industry?

The terms the students encountered and were expected to understand were as follows:

Addition, aliphatic compounds, anti-oxidant, Cuprammonium process, detergent, electronic formula, esterification, fibers, homologous series, isomer, latex, mercerizing, monomer, mordant, paraffin, polymer, polysyrene, saponification, saturated hydrocarbons, structural formula, substitution, thermoplastics, thermosetting, unsaturated hydrocarbons, Viscose process and vulcanization.

The students were drilled on the drawing of structural formulas and the naming of organic compounds. Once they had mastered the idea of structural formulas, teacher A drew examples of complicated organic structures. Some of the well-known organic substances diagrammed were aspirin, oil of

wintergreen, TNT, soap and nitroglycerin.

The majority of the students' time was spent in the laboratory under the supervision of the chairman, teacher "B". He introduced the students to the experiments by explaining the necessary precautions. The use of caustic sodium hydroxide received special attention. The students were presented with seven experiments. A formal laboratory report was required for each experiment. The seven experiments were as follows:

1. Preparation of Esters
2. Preparation of Soap
3. Properties of Soap
4. Preparation of Ink
5. The Chemistry of Foods
6. Iron in Foods
7. Dyeing Cloth

Once the first experiment was begun, the students were permitted to work at their own pace. Most of the students were able to complete the seven experiments in the alloted time. Some students had various technical difficulties and required assistance from teacher B and the laboratory aides.

About twenty students were able to complete the seven experiments before the end of the three weeks. They were given

enrichment experiments which entailed the preparation of cosmetics and paints.

Reports for the regular and enrichment experiments were turned into teacher B. He graded these reports. The students were given points for each report. A ten-point system was used for the evaluation of the reports. The students' laboratory grades were determined from the total number of points the students had earned.

Some students had great difficulty with the unit on organic chemistry. These students had difficulty with the nomenclature and the structural formulas of organic compounds. The systems for naming organic and inorganic compounds are different and the students were not immediately able to grasp the difference. It was difficult for some students to visualize the structures of organic compounds in three dimensions.

Teacher A made appointments with the students having difficulties. He held review sessions in the library-seminar room on the days he was not lecturing. Explanations and drills were employed to assist these students.

Molecular model kits assisted the students in the visualizatinn of organic compounds. These kits were composed of wooden balls and steel pegs. The balls were colored to represent different elements. The steel pegs were used to connect the balls. The students were able to construct three-dimen-

sional models of molecular organic compounds.

The individual assistance required about one-half of teacher A's free time. The remainder of the time was devoted to the preparation of lectures. The construction of quizzes and a unit test was part of the lecture preparation.

When teacher A was lecturing, teacher B prepared the chemical reagents for the unit experiments. He also supervised the laboratory activities of the students who had free periods. Any chemistry student with a study period was permitted to work on experiments during open laboratory periods. Teacher B was available for assistance during these laboratory periods. Many students were able to catch up during free periods, while others were able to work ahead.

The evaluation of the students was a continual process. Teacher A graded the students on the basis of quiz and test points. Teacher B. determined the total points for each student. The students' grade for the unit was determined by the consideration of the lecture and laboratory grades.

Culmination of the unit was accomplished by the review of the unit test and a movie on fuels and heat.

Another phase of instructional organization was the employment of laboratory assistants. The laboratory assistants were superior students who had taken chemistry the previous year. These assistants were responsible for replenishing

laboratory reagents and equipment. They also aided students who had technical difficulties with their experiments. Two or three assistants each period diminished the number of students the instructors had to assist. These students deserve credit for their help in the execution of the team teaching project.

The cooperative team teaching project in chemistry at times appeared unstructured, but the participating members were able to rotate the responsibilities with great ease. The lecture, laboratory and individual assistance responsibilities were distributed with the greatest equality possible.

Educational Center

An elaborate teaching organization as previously presented would be difficult to administer without adequate facilities. The physical plant for chemistry was built specifically for the team teaching project. These facilities constitute probably the most well-equipped high school educational center for chemistry.

The lectures and movies were presented in an amphitheater-style lecture room. Seventy-two student seats were elevated on tiers in this 30 x 46 foot room. The seats were floor-mounted swivel chairs with tables as the writing area.

The room has a fully-equipped demonstration table and fume exhaust hood. Numerous demonstrations were presented with the lectures. To aid the lecturer, the room was equipped with a

public address system.

A fifteen foot blackboard was supplemented with other audio-visual equipment. The room has a movie projector and motorized screen. In addition, the room has recessed ceiling lights which enabled note-taking in a darkened room. An overhead projector was available and used frequently, but not to the exclusion of the blackboard.

The laboratory experiences of the students were considered to be as important as lectures; therefore, the laboratory and surroudning rooms were elaborately furnished. The laboratory was a 70 x 36 foot room with six perimeter and six island laboratory tables. The perimeter and island tables could each accommodate a maximum of four and eight students respectively. The laboratory tables had a total of 504 drawers and were equipped with gas, water and AC/DC electricity. In the front of the laboratory was a fully-equipped demonstration table for the instructor. The room was also equipped with a public address system.

The laboratory was situated in a lengthwise east-west directinn. It was rimmed by perimeter tables on the north and east, whereas the southern and western ends of the room were bordered by an office and several special-purpose rooms. The office was a 10 x 20 foot room which is glass-enclosed and elevated six inches above the laboratory floor. This

enabled the teacher having a free period to aid in the supervision of the students from his office desk.

A 10 x 26 foot glass-walled room adjoining the southern end of the laboratory was designated as the library-seminar room. It was equipped with a blackboard, two small tables and fifteen chairs. One wall had a bookshelf with the "McGraw-Hill Encyclopedia of Science and Technology," and "Van Nostrand's Scientific Encyclopedia."[4] In addition, the library-seminar room had a supply of high school and college chemistry textbooks. The periodical magazines, The Atom, Chemical and Engineering News, Science World, Science Digest and Journal of Chemical Education were furnished in this room.

On the western end of the laboratory were three special-project rooms. Two rooms were equipped with all the utilities of the laboratory and were used by the more advanced chemistry students. The third special-project room was supplied with four highly sensitive analytical balances. These rooms were glassed from the ceiling to mid-wall which enabled supervision from the laboratory.

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[4]McGraw-Hill Encyclopedia of Science and Technology, McGraw-Hill Book Company, Inc., New York, 15 volumes, 1960. Van Nostrand's Science Encyclopedia, D. Van Nostrand Company, Inc., Princeton, New Jersey, 1958.

Chemical supplies and equipment were stored on wall to ceiling shelves in a 10 x 23 foot stockroom. In addition, the stockroom was equipped with a work bench, glass tubing cabinet and a water deionizing apparatus. This room was also supplied with all the laboratory utilities.

Connecting the lecture room and the laboratory was a preparation room. This room was used as a special-project area for students and as a preparation area for lecture demonstrations. Doors at both ends of the room made the lecture room accessible from the laboratory.

The benefactors of this laboratory-activity area were the students, who were equipped with personal drawers. These drawers were completely supplied with semi-micro equipment. The students also had access to a general drawer, which contained equipment shared by all the students at this station.

The students' supplies and equipment were situated so that they did not have to move needlessly about the laboratory. Each student was assigned a self-sufficient station for work. This station had an acid-base reagent tray and a tote tray of chemicals. The tote tray contained about one hundred half-ounce bottles with solid chemicals and liquid reagents. These chemical trays provided the chemicals used for experimentation during the year. In addition to the individual equipment, there was one triple beam balance and centrifuge available for

every three students. Fundamentally, this team teaching organization was devised to encourage and promote the learning and teaching of chemistry.

CHAPTER IV

EVALUATION OF THE PROJECT

As stated in the foregoing, the purpose of this study was to compare the instruction of chemistry by a team approach with the conventional method employed the previous year. In the methods of research employed, provisions were made to insure prudent control.

The objective evaluation consisted of standardized tests of intelligence and achievement. The data from these measurements were treated statistically--in most cases by the use of the analysis of covariance.

Several instruments were used to obtain data from the students and teachers. A questionnaire was used to determine the students' reactions. The students were asked if they thought the project class was providing more, less or the same opportunities as their regular classes. They were asked to evaluate some generally accepted procedures and practices.

Another instrument was an analysis by the participating teachers. The teachers evaluated certain procedures and practices to determine whether they were being used as frequently and successfully in the experimental classes as in the regular

classes. A study of opinions, suggestions and reactions of persons involved in an experiment are enlightening and valuable. From these subjective analyses, it was possible to draw conclusions about the attitude of the personnel. The procedures needing improvement and adjustment were considered as well as the more successful aspects of the project. The results of the various instruments of analysis are presented in this chapter.

Intelligence

The intelligence of the control and experimental groups were compared. The California Test of Mental Maturity, Short Form, was administered to these groups of students prior to their entry into high school. The students' MR's (I.Q.) were obtained from the test report records furnished by the school personnel department.

The frequency distributions for the control (1960-1961) and experimental (1961-1962) groups are tabulated in Table I.[1] The mean MR for the control group was 119.01 with a sigma of 11.20. The experimental group had a mean MR of 116.77 and a sigma of 11.44.

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[1]Table I, page 67.

TABLE I

FREQUENCY DISTRIBUTIONS OF THE MATURATION RATES (I.Q.)
OF THE CONTROL (1960-1961)
AND THE EXPERIMENTAL (1961-1962) GROUPS
CALIFORNIA TEST OF MENTAL MATURITY, SHORT FORM

MR Intervals	1960-1961 (Control)		1961-1962 (Experimental)	
	Frequency	Cumulative Frequency	Frequency	Cumulative Frequency
143-145	1	166	1	185
140-142	4	165	1	184
137-139	3	161	3	183
134-136	2	158	4	180
131-133	9	156	10	176
128-130	12	147	15	166
125-127	12	135	17	151
122-124	22	123	13	134
119-121	17	101	13	121
116-118	24	84	22	108
113-115	13	60	21	86
110-112	14	47	16	65
107-109	15	33	19	49
104-106	12	18	9	30
101-103	3	6	7	21
98-100	2	3	7	14
95- 97	1	1	3	7
92- 94	0	0	4	4
	N = 166.00 Mean = 119.01 Median = 118.90 Sigma = 11.20		N = 185.00 Mean = 116.77 Median = 116.89 Sigma = 11.44	

A comparative analysis of the mean MR's from the two groups was performed.

The null hypothesis (that there is no difference between the two means) was tested by the use of the Fisher "t" test for the difference between uncorrelated means. The t's required for 347 degrees of freedom were 1.967 for the .05 level of confidence and 2.590 for the .01 level of confidence.

The obtained t was 5.98; therefore, the null hypothesis was rejected. The significant difference was beyond the .01 level of confidence. There was a very significant difference between the control and experimental groups. Statistically, the control group was more intelligent than the experimental group.

Achievement

Academic achievement in chemistry for the control and experimental groups was determined through the use of the Co-operative Chemistry Test, Form Z. The test was administered to the groups as a pre-test and at the conclusion of one year of chemistry.

The pre-test raw scores of the control and experimental groups were tabulated into frequency distributions. Table II contains the frequency distributions for the two groups.[2]

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[2]Table II, page 69.

TABLE II

FREQUENCY DISTRIBUTIONS OF THE RAW SCORES
OF THE CONTROL (1960-1961) AND EXPERIMENTAL (1961-1962) GROUPS
PRE-TEST

Raw Score Intervals	1960-1961 (Control)		1961-1962 (Experimental)	
	Frequency	Cumulative Frequency	Frequency	Cumulative Frequency
56-60	1	166	0	185
51-55	0	165	0	185
46-50	0	165	1	185
41-45	0	165	0	184
36-40	0	165	0	184
31-35	0	165	1	184
26-30	2	165	1	183
21-25	4	163	4	182
16-20	9	159	11	178
11-15	30	150	19	167
6-10	61	120	72	148
1- 5	59	59	76	76
	N = 166.00 Mean = 8.55 Median = 7.95 Sigma = 6.48		N = 185.00 Mean = 7.80 Median = 7.15 Sigma = 6.10	

The mean raw scores for the control and experimental groups were 8.55 and 7.80, respectively. The standard deviations for the 1960-1961 group was 6.48, whereas, the sigma for the experimental group was 6.10.

A comparative analysis of the mean raw scores from the two groups was performed. The Fisher "t" test for the difference between uncorrelated means was employed to test the null hypothesis. The t's required for 347 degrees of freedom were 1.967 for the .05 level of confidence and 2.590 for the .01 level.

The calculated t was 13.50; therefore, the null hypothesis was rejected. The difference was beyond the .01 level of confidence. There was a very significant difference between the control and experimental groups. Statistically, the control group (1960-1961) had a slightly better knowledge of chemistry than the experimental group (1961-1962) at the beginning of the course.

The final test's raw scores of the control and experimental groups were tabulated in frequency distributions. Table III contains the frequency distributions for the two groups.[3] The mean raw scores for the control and experimental groups were 29.00 and 28.75, respectively. The standard deviation for the 1960-1961 group was 12.90, whereas, the sigma for the experimental group was 11.75.

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[3]Table III, page 71.

TABLE XII

FREQUENCY DISTRIBUTIONS OF THE RAW SCORES
OF THE CONTROL (1960-1961) AND EXPERIMENTAL (1961-1962) GROUPS
FINAL TEST

Raw Score Intervals	1960-1961 (Control)		1961-1962 (Experimental)	
	Frequency	Cumulative Frequency	Frequency	Cumulative Frequency
73-77	0	166	3	185
68-72	2	166	0	182
63-67	1	164	0	182
58-62	0	163	0	182
53-57	5	163	2	182
48-52	7	158	6	180
43-47	6	151	10	174
38-42	17	145	17	164
33-37	25	128	19	147
28-32	21	103	31	128
23-27	27	82	38	97
18-22	29	55	35	59
13-17	11	26	16	24
8-12	8	15	6	8
3- 7	7	7	2	2
	N = 166.00 Mean = 29.00 Median = 28.20 Sigma = 12.90		N = 185.00 Mean = 28.75 Median = 27.40 Sigma = 11.75	

The mean raw scores were tested for statistical differences. The Fisher "T" test for the difference between uncorrelated means was used to test the null hypothesis. The t's for 347 desgrees of freedom again were 1.967 and 2.590 for the .05 and .01 levels of confidence, respectively.

The obtained t for the raw score differences was .92. The test did not meet the necessary statistical requirements for significant differences. Therefore, the null hypothesis had to be accepted. Statistically, there was no significant difference in achievement between the control and experimental groups.

Item Analysis

In order to ascertain in detail any achievement differences between the two groups, an item analysis was performed. The primary purpose of the analysis was to determine the number of correctly answered items. A comparison of the two groups was made for each unit and the entire test.

The 166 control group students answered 5,875 items correctly on the 81 item achievement test. The 185 experimental group students correctly answered 6,878 items. The group averages were 35.2 correct items per students for the control group and 37.1 for the experimental group. The percentage difference was 5.12. The experimental group answered 5.12 percent more items correctly than the control group. The experimental group was not necessarily 5.12 percent better than the control group,

but the results indicate that the 1961-1962 group was able to recognize more of the correct responses.

Table IV represents a more detailed summary of the chemistry achievement tests.[4] The items were grouped into the units they tested. Units II, III, IV and V were predominately concerned with the basic principles, concepts and skills. The test items pertinent to these units were primarily concerned with these basic fundamentals and skills.

The other units presented some new concepts, but most of the subject matter pertained to factual information. The test items for these units primarily probed the students' knowledge of factual information. Unit VI was devoted to the study of the nonmetals. Nine of the fifteen test items were concerned with facts about nonmetals and their characteristics.

Table IV shows that the experimental group was more successful with the basic fundamentals and skills. The results on Unit IV were very encouraging since this unit was concerned with chemical calculations. Greater emphasis was placed on this phase of the course this year. The control group was more successful with the factual information. This was not surprising, since less emphasis was placed on the learning of facts in the experimental group. The students were mostly

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[4]Table IV, page 74.

TABLE IV

ITEM ANALYSIS OF THE CO-OPERATIVE CHEMISTRY TEST, FORM Z
A COMPARISON OF THE CONTROL (N = 166) AND EXPERIMENTAL (N = 185) GROUPS

Unit	Number of Items	Correct Responses		Percent Correct		Difference (%) (1961-62) - (1960-61)
		1960-61	1961-62	1960-61	1961-62	
I	5	398	424	48.0	45.8	- 2.2
II	13	1,100	1,256	51.0	51.5	- 0.5
III	14	1,143	1,329	49.3	51.3	- 2.0
IV	12	666	909	34.4	41.0	- 6.6
V	4	192	266	28.9	36.0	- 7.1
VI	15	1,149	1,134	46.1	40.9	- 5.2
VII	8	661	801	49.8	54.1	- 4.3
VIII	1	64	21	38.6	11.4	-27.2
IX	6	356	501	35.7	45.0	- 9.3
X	3	146	237	29.3	31.7	- 2.4
Totals	81	5,875	6,878			

responsible for the accumulation of facts. The time usually used by the teacher for the presentation of facts was devoted to laboratory work.

The Student Questionnaire

The experimental group students were asked to compare the team teaching class with regular classes in other subjects. The students evaluated the variety of learning situations, instructional materials, and sources of information. Table V represents the results to the student questionnaire.[5]

The students believed that a greater variety of approaches to learning were offered by the experimental method. They felt that there were many opportunities for the use of the library-seminar room. Eighty-nine percent of the students felt that there were at least as many opportunities to use other printed material besides the textbook in their project class as in their regular classes.

The experimental group students did not give very many oral reports and demonstrations; therefore, the high percentage of unfavorable student responses in regard to hearing student reports are to be expected.

Three speakers from outside the school were responsible for the high percentage of favorable responses for hearing

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[5]Table V, page 76, 77.

TABLE V

STUDENT QUESTIONNAIRE SUMMARY[6]
RESPONSES OF THE STUDENTS (N = 185) TO EACH ITEM
THE FIGURES REPRESENT PERCENT OF A, B OR C RESPONSES

In this class, the opportunities to do certain things may be MORE, LESS or about the SAME as in most other classes. Circle your answer for each statement as follows:

A - if you think there are MORE opportunities
B - if you think there are LESS opportunities
C - if you think the opportunities are about the SAME

Statement	A	B	C
1. to meet in comfortable, pleasant classrooms	87.5	1.1	11.4
2. to be unnoticed when you misbehave	41.0	17.5	41.5
3. to make friends with many other pupils	48.5	10.5	41.0
4. To enjoy the subject and the classwork	57.5	10.5	32.0
5. to be successful in the work required of the class	34.0	15.0	51.0
6. to learn how to study effectively	20.0	24.0	56.0
7. to learn to think for yourself	62.0	8.3	29.7
8. to do things in which you are personally interested as part of the classwork	44.0	18.2	37.8
9. to learn how to behave properly	24.0	15.0	61.0
10. to be challenged to do your best	59.5	8.5	32.0
11. to use printed materials besides the textbook	58.5	11.0	30.5
12. to use the library in connection with the subject or subjects being studied	52.0	13.0	35.0
13. to hear reports from other pupils	5.0	70.0	25.0
14. to hear speakers from outside the school	61.0	11.5	27.5
15. to get individual help with classwork when you need it	46.5	19.0	34.5
16. to check your own progress in the classwork	29.5	15.5	55.0
17. to understand the purposes of assigned classwork	25.5	18.5	56.0

[6]Lee L. Bloomenshine and Malcolm T. Brown, "San Diego, California, Conducts Two-Year Experiment with Team Teaching", NASSP. Bulletin, XLV (January 1961), 163.

TABLE V - CONTINUED

STUDENT QUESTIONNAIRE SUMMARY
RESPONSES OF THE STUDENTS (N = 185) TO EACH ITEM
THE FIGURES REPRESENT PERCENT OF A, B OR C RESPONSES

For each of the following statements, circle your answer as follows:

A - if you LIKE the situation described
B - if you DISLIKE the situation described
C - if you are INDIFFERENT--you feel you can't really say you like or dislike the situation described

Statement	A	B	C
18. being in a large class	36.5	38.0	25.5
19. having more than one teacher in the classroom	64.0	17.0	19.0
20. having different teachers at different times or for different activities	47.5	27.0	25.5

outside speakers. Illinois Bell System supplied two speakers and the Atomic Energy Commission supplied one from Oak Ridge. The speakers presented lecture demonstrations to the classes in the lecture room.

The provisions for various interests and levels of ability were favorably evaluated by the students (items 8, 10 and 15 of Table V, page 76). At least eighty percent of the students felt that sufficient opportunities were available for their varying interests and abilities. Almost sixty percent of the students felt that there were more challenging opportunities in the experimental class than there were in the regular classes.

The students were given a greater amount of responsibility for their learning and discipline. The evaluation of this aspect of the team teaching project was favorable, but not as highly favorable as some of the other aspects. Sixty-two percent of the students felt that there were more opportunities to think for themselves. The opportunities to check their own progress and to learn to study effectively were about equal in the experimental and regular classes. The students saw little difference between their project class and regular classes in terms of other self-directed activities.

The opportunities to be unnoticed when they misbehaved was considered by the students to be greater. Twenty-four percent of the students felt that there were more opportunities to

learn how to behave properly. Student discipline had been considered a most important obstacle when team teaching was being considered. This concern for student discipline by the instructors was unfounded. The team teaching organization reduced this problem tremendously. The teachers felt that the instances of student misbehavior were less in the large classes than in the regular chemistry classes of the previous year.

The social aspects of the team teaching project were favorably evaluated by the students. The more liberal student schedule and greater opportunities to meet more students impressed many students. New facilities and equipment probably played a large part in this favorable opinion. The students took great pride in their new facilities.

The reactions toward a large class and a "team" of teachers are noted in items 18, 19 and 20, Table V, page 77.

The most unfavorable reaction of the students was toward being in a large class. Most of the students were in favor of the team of teachers, but thirty-eight percent did not like large classes.

The teachers attributed the unfavorable reactions toward being in a large class to three basic factors. First, many students could not adjust to a large class. They had difficulty adjusting to a new and different student-teacher rapport which prevailed in the large-group situation. Second, individual assistance, some of the students said, was not always

extensive enough. This periodic defficiency tended to detract from the success of the large-group structure. Third, some students felt that the evaluation in the team teaching class was more objective than in their regular classes. The impression of some students was that, grade-wise, they would have been more successful in a regular classroom situation.

Teacher observations

The team members organized the curriculum to provide for more student-centered activities. This was to be accomplished through an emphasis on laboratory experiences. Table VI was constructed to show the time allotments for various phases of the chemistry program.[7] The two groups' time for lecturing, laboratory and movies were compared.

The time for lecturing was diminished from 135 to 65 days. The figures show that the control group spent 78.5 percent of their time listening to lectures and discussion while the experimental group used 37.3 percent of their time for lectures.

The experimental group devoted 10.2 percent of their time to viewing movies. The eighteen days for movies represents an increase of fourteen days more than was spent by the control group. The total number of days for lectures and movies used by the experimental group was still less than that used by the

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[7]Table VI, page 81.

TABLE VI

APPROPRIATIONS OF THE TIME FOR THE VARIOUS PHASES OF CHEMISTRY INSTRUCTION CONTROL GROUP (1960-1961) AND EXPERIMENTAL GROUP (1961-1962)

Unit	Weeks		Days					
			Lecture		Laboratory		Movies	
	1960-61	1961-62	1960-61	1961-62	1960-61	1961-62	1960-61	1961-62
I	4	4	13	7	3	8	1	3
II	3	3	12	5	0	8	0	1
III	5	4	20	8	5	9	0	3
IV	4	4	12	7	2	8	0	1
V	3	3	12	5	3	8	1	1
VI	8	6	32	10	6	13	0	5
VII	4	4	14	8	4	9	2	1
VIII	3	2	12	8	3	4	0	2
IX	2	3	8	4	2	10	0	1
X	1	3	0	3	5	11	0	0
Total	37	36*	135	65	33	88	4	18
% of time	-	-	78.5	37.3	19.2	51.3	2.3	10.2

* 37th week was used for review

control group.

A primary purpose of the team teaching project was to provide for more student responsibility for learning. The project course successfully provided the students with more student-centered activities. The time devoted to laboratory experiences was over twice as much for the experimental group. The control group spent 19.2 percent of the time in the laboratory compared to 51.3 percent of the time for the experimental. This represents a very significant change in the chemistry program at Riverside-Brookfield Township High School.

Student interest in the team classes was observed over the entire year. The students did not show too much enthusiasm at the start of the team teaching course. To many, the large-group situation was contrary to all their previous experiences with classes. As the year progressed, the interest improved until it was found to be better in the experimental group than in the previous year's group. The interest at the end of the year had reached a maximum.

For the last unit the students were introduced to qualitative analysis methods. Three lecture periods were devoted to the presentation of analytical techniques. The students worked most of the time in the laboratory. A count was made of the number of students who came into the laboratory during their free periods. Three weeks were used to study the student interest. Table VII was constructed to show the number of

students who came into the laboratory during their free periods.[8]

In a fifteen-day period, 536 students worked extra periods in the laboratory. This represented an average of about thirty-five students each day. The average represented about twenty percent of the 1961-1962 chemistry enrollment. This figure cannot be used as an absolute example of interest. Some of these students were in the laboratory extra hours because they were behind schedule in their work. However, a majority of the students who came into the laboratory for extra periods were finished with the scheduled work ahead of time. Some of these students did two special experiments on paper chromatography, which is a new analytical technique. In general, the interest within the control group did not compare favorably with the experimental group. The experimental group, through greater experience, showed a greater self-confidence when handling learning situations in chemistry. This development is probably a most significant concomitant of team teaching in chemistry.

The teachers felt that they had more opportunities to use a variety of approaches and materials for instruction in the experimental project. They took advantage of these opportunities and used a greater variety of approaches.

The team members found that they spent more time planning

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[8]Table VII, page 84.

TABLE VII

THREE-WEEK RECORD OF STUDENTS USING THE LABORATORY DURING THEIR FREE PERIODS

Date (1962)	Number of Students
May 17	45
May 18	34
May 21	21
May 22	16
May 23	25
May 24	37
May 25	35
May 28	43
May 29	33
May 31	30
June 1	49
June 4	55
June 5	32
June 6	45
June 7	36
Total	536
Daily average 536 students/15 days	35.7
Percent of chemistry enrollment 35.7/185 x 100	19.2

class activities and preparing materials for instruction. The consumption of time was attributed to personal adaption to the new teaching situation. The adjustment from teacher-centered to more student-centered activities was accomplished with extremely good personal effort.

The instructors agreed that the team approach, with the liberal laboratory schedule, provided a challenge for the superior students. At the same time, the individual acceleration policy provided an appropriate pacing for the slower student.

Two phases of the program, individual assistance and paperwork, were not satisfactory to the team members. The individual assistance was not as comprehensive as the members felt it should have been. The teachers were available for assistance, but many students were too shy to ask for help. A more aggressive system for assistance must be instituted.

The critical evaluation by test analysis, student reactions and teacher observations were presented in this study. The information was used to improve the team teaching program. An objective approach was used in these analyses. The evaluations indicate that considerable progress has been made in the use of the team approach to the instruction of chemistry.

CHAPTER V

SUMMARY AND CONCLUSIONS

A Backward Look

The project described in this study represented the first year of team teaching in chemistry at Riverside-Brookfield High School. This study was conducted to determine the effectiveness of team teaching as an instrument of learning. The effective utilization of the teaching talents of the team members was also considered. Some conclusions about the specific hypotheses will be presented in this chapter.

The greatest difficulty in this study was to limit the number of variables. The same student could not take both methods of instruction, so no absolute comparison was possible. Therefore, the experimental group had to be compared with a control group of the previous year. The control group was taught chemistry by the traditional method during the 1960-1961 school year. The following year the experimental group received chemistry instruction from a team of two teachers. The two teachers taught chemistry to the control and experimental groups of students. The evaluation of the project by the team members represents the only direct comparison of the two groups.

The general intelligence and academic achievement of the two groups were compared. Statistically, the control group was found to be more intelligent than the experimental group. A comparison of academic achievement of the two groups revealed no significant difference. The control and experimental groups experienced about the same academic growth.

The control group should have experienced a greater academic growth than the experimental group, but this was not observed. Therefore, the team approach was at least as effective as the traditional method of chemistry instruction. There were strong indications that the experimental approach was an improvement over the previously used instructional method. The evidence for this indication was the academic achievement of the lesser talented experimental group.

A greater emphasis of concepts, principles and basic skills was planned for the team teaching approach. The experimental group was shown to have acquired a better working knowledge of the concepts, principles and basic skills than the control group.

In the team teaching project acquisition of factual information was mainly the responsibility of the students. The control group, which received most of the factual information from the instructors, showed a greater success in the comprehension of factual information.

The students of the experimental group reacted favorably to the team approach. The interest and enthusiasm was much better in the last year than it had been the previous year, as evidenced by the number of students working extra hours in the laboratory. The liberal scheduling of laboratory experiments and a greater availability of the laboratory stimulated many students. The more gifted students were not delayed by the slower students. The slower students were not prodded into frustration by an inflexible laboratory schedule for the more capable students.

Thirty-eight percent of the experimental group students disliked being in a large class. Observed disadvantages were found to be related to the large-group structure. Some students had difficulty adjusting to the new student-teacher rapport. The difficulty of adjustment to a large class worked to the disadvantage of many students. In addition, some students felt at a disadvantage to be graded by more than one teacher. Their dislike for a large class was directly related to this fact.

Assistance for individual students was available, although it was not always sought by the students. The reteaching phase of the team teaching program was not as comprehensive as originally planned. Adjustments and improvements of the reteaching phase were necessary.

The team members were extremely encouraged by the results of the team teaching approach. At times, they found that more time was spent in the administration of the team teaching project, but this was attributed to the newness of the course. The organization of the laboratory and paperwork accounted for the majority of the extra time. Once the laboratory was completely equipped and the adjustment of the paperwork was accomplished, the time spent by the teachers was more effectively used for the experimental classes.

The lecture phase of the team teaching project permitted less student participation. There were fewer student reports in the experimental classes. This was considered to be disadvantageous to the students. The writer feels that less participation during lectures was substituted by an increase of individual participation in the laboratory. The students were able to express their observations and conclusions in their laboratory reports. These written reports required the utilization of as many intellectual thought processes as any oral report or student demonstration.

The advantages of team teaching far out-weighed the disadvantages. The number of student discipline problems has been found to be less in the experimental classes. The students were able to hear more speakers from outside the school and see more movies. The students were able to receive instruction from two

teachers. This meant the students often learned how to view and solve a problem from two different approaches. A group of students were not restricted to the instructional practices of only one chemistry teacher. More help through various means was available to the students. The students had more opportunities to think for themselves in the team classes.

The team approach provided the teachers with more time to plan and prepare for lectures. The better-planned lectures and better-prepared lecture-demonstrations resulted in a saving of the students' time. The subject matter was presented to the students in fewer lecture periods. This enabled the students to spend more time engaging in individual learning experiences.

Continuity of instruction in team teaching presented an administrative advantage. The students did not lose time for learning due to the absence of an instructor. In most instances substitute teachers were not necessary since a team member was usually available to assume the duties of the absent member.

The combining of the teaching talents of the team members represented another administrative advantage. The strengths of one team member compensated for the weaknesses of the other member. The teaching techniques of the team members were not identical so the preferred techniques of each member were employed. This resulted in a strengthened instructional atmosphere for the teachers and an improved learning situation for the students.

The imponderables in this study were: (1) the affect of the new facilities on the success of the project, and (2) the affect of student enthusiasm on the success of the project.

The facilities for team teaching in chemistry were carefully planned. The new facilities provided the students with new and more equipment. There was no doubt in the writer's mind that the facilities have aided the observed academic growth of the students. It was, however, very difficult to conceive that the student growth was accomplished by the influence of the new facilities alone. The students took pride in their new educational center, but this was not sufficient enough to account for the ultimate student growth. However, it should be understood that team teaching is dependent on the facilities used in this project and cannot work effectively independently of proper facilities. Therefore, the team teaching concept and atmosphere is a unity of plans, competent teachers and substantially adequate facilities and equipment.

The student enthusiasm for the new course was noticeable during the past year. The team taught course was not presented to the students as an experiment or as a challenge. The subject was introduced in the same manner as it had been in the previous years. The students did not have any knowledge of this study and were not motivated toward any ulterior end other than education. The newness of the method did arouse extra stu-

dent enthusiasm, but the writer does not believe that the student growth was accomplished by enthusiasm alone.

Team teaching is an education marriage of teachers. The teachers are engaged in a very closely knit pattern of instruction. The sharing of responsibilities means that the teachers must continually be in contact with each other. The personal contact means that a high degree of cooperation is necessary.

The chemistry project at Riverside-Brookfield High School has achieved a high degree of success through a well-organized utilization of its team members. The partners in this educational marriage have complimented each other in many respects, enhancing the team teaching program. The results of the team project are not absolutely satisfactory, but are very encouraging.

Forward Look

The high school in this study has already expanded its chemistry team membership to three teachers. The three teachers have six double-sized classes, with a total enrollment of 270 students. The organization of the team program is about the same as the 1961-1962 program. The third teacher rounds out the program. The original plan for team teaching in chemistry was for an optimum size of three teachers. The program for the 1962-1963 academic year has three teachers working as a teaching team. This arrangement should provide the free time for the

teachers as originally expected. The teachers should have more free time for effective individual assistance and personal projects.

A future study could be made to determine the effectiveness of a three-member team. The study could compare the three-member team with the two-member team. A point of diminishing returns might be reached as the number of team members increases. The study might possibly show that the two-member team was more effective than a three-member team.

The demands of every school district are different. The attitudes and interests of the students vary in different communities. Each school district should strive to use its educational resources most effectively. There is not a simple solution to the effective use of teachers and methods. Each school must review its own objectives and methods to evaluate the methods being employed. If there is a necessity and a desire to make changes, then team teaching in chemistry is a possibility. The facilities for this new method of instruction must be adequate, otherwise, the program will not be feasible.

Team members of a team project must be cooperative and willing to share their teaching methods with their members. Team members of radically different personalities and educational objectives have little chance of cooperating toward the achievement of a successful team teaching situation. The

complementary nature of the team members represents the most important criterion to be considered in the formation of a teaching team.

The study was not planned as an advocation of team teaching in chemistry, but an objective presentation of a new method. The writer has found team teaching to be successful and there is no reason to expect the present program to diminish or falter, providing the faculty cooperation and professional growth continue. Team teaching in chemistry at Riverside-Brookfield Township High School has not produced quick, magical or easily measured gains in student achievement, but as a method of instruction, it has been very reassuring.

BIBLIOGRAPHY

I. PRIMARY SOURCES

A. BOOKS

Cunningham, Luvern L. Team Teaching: Where Do We Stand? University of Chicago, Chicago, Illinois, 1960.

Morse, Arthur D. Schools of Tomorrow - Today. University of the State of New York, The State Education Department, Albany, New York, 1960.

Pursuit of Excellence, Education and the Future. Rockefeller Foundation, Inc., Doubleday and Company, Inc., Garden City, New York, 1958.

Time, Talent and Teachers. The Ford Foundation, 447 Madison Avenue, New York 22, New York, 1960.

Trump, J. Lloyd. Images of the Future. Urbana, Illinois, Commission on the Experimental Study of Utilization of the Staff in the Secondary School, 1959.

-----. New Direction to Quality Education. Urbana, Illinois, 1959.

-----. New Horizons for Secondary School Teachers. Urbana, Illinois, 1959.

----- and Baynham, Dorsey. Focus on Change, A Guide to Better Schools. Chicago, Illinois, Rand McNally, 1960.

Tyler, Ralph W. Basic Principles of Curriculum and Instruction. University of Chicago Press, Chicago, Illinois, 1950.

B. ARTICLES

Anderson, Edward and Harkness, John C. "Plan Variability in High School Design," The Nation's Schools, LXV (April 1960), 83-88.

Anderson, Robert H. "Team Teaching," National Education Association Journal, L (March 1961), 52-54.

-----. "Team Teaching in Action," The Nation's Schools, LXV (May 1960), 62-65.

-----. "Team Teaching; New Learning Concepts Demand Changes in School Plant Design," The Nation's Schools, LXV (June 1960), 75-82.

Andree, Robert G. "An Image of the Future Arises in Olympia Fields," The Nation's Schools, LXV (July 1960), 81-85.

-----. "Large Classes and Effective Teaching," The Clearing House, XXXIII (February 1959), 334-336.

Bahner, John M. "Grouping Within a School," Childhood Education, XXXVI (April 1960), 354-356.

-----. "Reading Instruction in Various Patterns of Grouping in Grades Four to Six," Conference on Reading, University of Chicago, Supplementary Monographs, (1959), 95-98.

Baynham, Dorsey. "A School of the Suture in Operation," Phi Delta Kappan, XLII (May 1961), 350-354.

-----. "Selected Staff Utilization Projects in California, Georgia, Colorado, Illinois, Michigan and New York," National Association of Secondary-School Principals. Bulletin, XLVI (January 1962), 14-98.

Bernucci, Vincent and Hartdeger, Max. "How to Use Team Teaching in Industrial Arts," Industrial Arts and Vocational Education, L (January 1961), 18-20.

Bimmex, Henry E. "Newton Plan Challenges Traditions of Class Size," National Association of Secondary-School Principals. Bulletin, XLIII (January 1959), 60-64.

Bissex, Henry E. "Second Stage: Revision, Extension of Newton Plan Studies," National Association of Secondary-School Principals. Bulletin, XLIII (January 1959), 106-119.

Bloomenshine, L. L. and Brown, T. Malcolm, "San Diego, California, Conducts a Two-Year Experiment with Team Teaching," National Association of Secondary-School Principals. Bulletin, XLV (January 1961), 146-166.

-----. "Team Teaching in San Diego; The First Year," National Association of Secondary-School Principals. Bulletin, XLIV (January 1960), 180-196.

Bovinet, Wesley G. "Glenbrook Reports on Four Experiments on Utilization of Staff," National Association of Secondary-School Principals. Bulletin, XLIV (January 1960), 244-253.

-----. "Intern Program, Team Teaching and Language Laboratory at Glenbrook High School," National Association of Secondary-School Principals. Bulletin, XLIII (January 1959), 249-252.

Braun, R. H. "Urbana, Illinois, Senior High School Changes Staff Patterns and Provides for Superior Students," National Association of Secondary-School Principals. Bulletin, XLV (January 1961), 209-215.

Brownell, John A. and Taylor, Harris A. "Theoretical Perspectives for Teaching Teams," Phi Delta Kappan, XLIII (January 1962), 150-157.

Bruntz, George B. "The Team Approach to Social Science Teaching," The High School Journal, XLIII (April 1960), 370-374.

Bush, Robert H. "Team Teaching Bandwagon," California Journal of Secondary Education, XXXV (April 1960), 207-208.

Carpenter, William C.; Fair, Jean E.; Heald, James E. and Mitchell, Wanda B. "Closed-Circuit Television is Used at Evanston Township High School," National Association of Secondary-School Principals. Bulletin, XLII (January 1958), 19-54.

Chase, Francis S. "New Conditions Confront Education," The School Review, XLV (January 1957), 3-11.

Chase, Francis S. "The School I Hope to See," National Education Association Journal, XLVI (January 1957), 164-166.

Clark, Arvel B. "Administering Team Teaching in East Side District. San Jose, California," National Association of Secondary-School Principals. Bulletin, XLVI (January 1962), 141-144.

Clawson, H. A. "English and Science Studies in Mattoon Senior High School," National Association of Secondary-School Principals. Bulletin, XLIV (January 1960), 257-263.

-----. "Mattoon, Illinois, High School Tries Team Teaching and Science Orientation," National Association of Secondary-School Principals. Bulletin, XLV (January 1961), 92-99.

-----. "Science Lecture and Team Approaches in English Tried in Mattoon High School," National Association of Secondary-School Principals. Bulletin, XLIII (January 1959), 245-247.

Conner, Berenice G. "Let Your Enthusiasm Show," The English Journal, L (December 1961), 626-628.

Conner, Henry D. W. "Team Teaching Program," Virginia Journal of Education, LIV (March 1951), 13.

Cooper, Walter L. "J. Sterling Morton High School and Junior College, Cicero, Illinois, Uses Tapes, Language Laboratory and Team Teaching," National Association of Secondary-School Principals. Bulletin, XLV (January 1961), 79-84.

Cope, Mrs. Charles W. and Medley, William. "Winfield, Kansas, High School Pioneers Team Teaching," National Association of Secondary-School Principals. Bulletin, XLVI (January 1962), 166-172.

Cordry, Vernon. "More Flexible Schedule at Fremont," California Journal of Secondary Education, XXXV (February 1960), 114-116.

Crandell, Edwin and Piel, Walter. "Birmingham Tries Team Teaching Experiment," Michigan Education Journal, XXXVIII (January 1961), 344-345.

"Critical Look At Team Teaching," The Instructor, LXXI (October 1961), 39-42.

Cunningham, Luvern L. "Keys to Team Teaching," Overview, I (October 1960), 54-55.

Dillman, Beryl R. "An Appraisal of the National Association of Secondary-School Principals' Staff Utilization Study at the Close of its First Two Years," National Association of Secondary-School Principals. Bulletin, XLIV (January 1960), 13-18.

Dillon, Carl L. "Taylorville, Illinois, Senior High School Uses Tape Recorders, Team Teaching and Large-Group Instruction to Improve Staff Utilization," National Association of Secondary-School Principals. Bulletin, XLIV (January 1961), 178-188.

Drummond, Harold D. "Team Teaching: An Assessment," Educational Leadership, XIX (February 1962), 160-165.

Elliot, Robert D. and Gamble, Eileen P. "Evanston, Illinois, Township High School Adds to Its Program; Health Education with Team Teaching," National Association of Secondary-School Principals. Bulletin, XLVI (January 1962), 226-228.

Ford, Paul M. "Different Day for the English Teacher," The English Journal, L (May 1961) 334-337.

Gillers, Max J. "One-Way Ticket to the Moon!," High Points, XLIII (May 1961), 67-68.

Goodlad, John I. "Appraising New Patterns of Organization for Reading Instruction," Conference on Reading, University of Chicago, Supplementary Monographs, (1959), 20-25.

-----. "Experiment in Team Teaching," The Elementary School Journal, LIX (October 1958), 11-13.

Grotberg, Edith; Metzler, Winifred; Pirtle, Alfred and Weigel, George. "Three Years of Experimentation in a Small School at Beecher, Illinois," National Association of Secondary-School Principals. Bulletin, XLIV (January 1960), 21-33.

Gurney, T. C.; Bleifeld, Maurice; Reese, James E. and Trink, Albert K. "What Responsibilities for the Principal in Organizing, Supervising and Evaluating Teaching Teams?," National Association of Secondary-School Principals. Bulletin, XLV (April 1961), 115-120.

Hagstrom, Ellis A. "New Opportunity for Outstanding Teachers," Grade Teacher, LXXVIII (January 1961), 13.

Hahn, Robert O. and others. "Team Teaching: A Second Look," The Journal of Teacher Education, XII (December 1961), 508-510.

Hanvey, Robert and Tenenberg, Morton S. "University of Chicago Laboratory School, Evaluates Team Teaching," National Association of Secondary-School Principals. Bulletin, XLV (January 1961), 189-197.

Harrison, William J. "Team Teaching at Muskegon, Michigan, Senior High School," National Association of Secondary-School Principals. Bulletin, XLVI (January 1962), 238-242.

Heller, Melvin P. and Belford, Elizabeth. "Team Teaching and Staff Utilization in Ridgewood High School," National Association of Secondary-School Principals. Bulletin, XLVI (January 1962), 106.

Hermeyer, Will and McGraw, Jean B. "Big Ideas for Big Classes," The School Review, LXVIII (Autumn 1960), 308-317.

Hoffman, John. "Team Teaching Spells Progress in Business Education," Business Education World, XLII (September 1961), 12-13.

Hoopes, Ned. "Team Teachers Play a Winning Game," The PTA Magazine, LV (March 1961), 29-31.

Hurley, William; Ceresa, Aldo; Songer, Ada; Pacotti, Louis; Clawson, Eileen and Chrisman, Byron. "Team Teaching and Use of Recorders in Taylorville Senior High School," National Association of Secondary-School Principals. Bulletin, XLIV (January 1960), 268-274.

Jensen, Laurell. "Eighth Grade Team Teaching at the Roosevelt Junior High School," California Journal of Secondary Education, XXXV (April 1960), 236-243.

Johnson, Robert H. "Extensive Study of Team Teaching and Schedule Modification in Jefferson County, Colorado, School District R-1," National Association of Secondary-School Principals. Bulletin, XLIV (January 1960), 78-93.

-----. "Transformation of the Sacred Secondary School Schedule," California Journal of Secondary Education, XXXV (February 1960), 96-105.

Johnson, Robert H. and Lobb, M. Delbert. "Jefferson County, Colorado, Completes a Three-Year Study of Staffing, Changing Class Size, Programing and Scheduling," National Association of Secondary-School Principals. Bulletin, XLV (January 1961), 57-78.

----- and others. "Continued Study of Class Size, Team Teaching and Scheduling in Eight High Schools in Jefferson County, Colorado," National Association of Secondary-Principals. Bulletin, XLIII (January 1959), 99-103.

Keach, Stanley J. "Team Teaching is Exciting!," Religious Education, XXXIV (September 1957), 12-13.

Koelscotte, Charles L. "The Course in Chemistry," National Association of Secondary-School Principals. Bulletin, XLV (December 1960), 111-126.

Larmee, Roy A. and Ohm, Robert. "University of Chicago Laboratory School Freshman Project Involves Team Teaching, New Faculty Position and Regrouping of Students," National Association of Secondary-School Principals. Bulletin, XLIV (January 1960), 275-289.

Lobb, M. Delbert; Noall, Matthew F. and Slichenmeyer, Harold L. "What Are Some Promising Practices in Team Teaching?," National Association of Secondary-School Principals. Bulletin, XLIV (April 1960), 2-7.

McCollum, T. E.; Henry, C. D. and Nesbitt, William O. "Snyder, Texas Continues Team Teaching," National Association of Secondary-School Principals. Bulletin, XLV (January 1961), 261-265.

Mahoney, William M. "Try Co-Ordinate Teaching." The American School Board Journal, CXXXIX (November 1959), 13-14.

Marsh, Robert. "New Technique Has Advantages for Both Students and Teacher," Illinois Education, L (November 1961), 111-112.

Marsh, Robert. "Team Teaching; New Concept?," The Clearing House, XXXV (April 1961), 496-499.

Maxwell, George W. and others. "How Effective is Team Teaching in General Business?," Business Education World, XLII (December 1961), 7-10.

Menacher, Julius. "Inter-Departmental Team Teaching in the High School," The Education Digest, XXVI (May 1961), 8-9.

Mitchell, Wanda B. "Evanston, Illinois, Township High School Expands Use of Closed-Circuit Television in 1957-59," National Association of Secondary-School Principals. Bulletin, XLIII (January 1959), 75-78.

-----. "Why Try Team Teaching," National Association of Secondary-School Principals. Bulletin, XLVI (January 1962), 247-252.

Nagle, Arthur J. "Team Concept in Organizing a Secondary-School Program," National Association of Secondary-School Principals. Bulletin, XXIII (April 1959), 86-87.

Nelson, Jack; Hahn, Robert O. and Robinson, Gertrude A. "Team Teaching for Teacher Education: The New Approach," The Journal of Teacher Education, XII (September 1961), 380-382.

Nelson, Roland H. "And Here is How an Educator Would Put the Perception Core into Effective Use," The Nation's Schools, LXV (March 1960), 85-87.

Nesbitt, William O. "Big Classes in Texas," Educational Screen and Audiovisual Guide, XXXVIII (November 1959), 594-596.

----- and Johnson, Palmer O. "Some Conclusions Drawn from the Snyder, Texas, Project," National Association of Secondary-School Principals. Bulletin, XLIV (January 1960), 63-75.

Noall, Matthew F. and Nuttall, Maurie. "Staff Utilization Through Language Arts Reorganization, Hurricane, Utah," National Association of Secondary-School Principals. Bulletin, XLIV (January 1960), 148-155.

Norton, Monte S. "Approaches to Team Teaching," National Association of Secondary-School Principals. Bulletin, XLIV (October 1960), 89-92.

O'Brien, M. Claire. "California Surveys Experimental Programs in Business Education," National Association of Secondary-School Principals. Bulletin, XLVI (January 1962), 99-102.

Ohm, Robert and Teneberg, Morton S. "Staff Reorganization Through Differentiation of Teaching Functions," National Association of Secondary-School Principals. Bulletin, XLIII (January 1959), 263-265.

Pannwitt, Barbara S. "Evanston, Illinois, Township High School Reports on Five Years of Projects, Including Television, Team Teaching and Large and Small Group Instruction," National Association of Secondary-School Principals. Bulletin, XLV (January 1961), 244-248.

Partridge, Arthur R. "Staff Utilization in Senior High School," Educational Leadership, XVIII (January 1961), 217-221.

Patterson, Gordon E.; Swenson, Lloyd G. and Johnson, Robert H. "Classes of Ten, Twenty, Thirty-Five and Seventy Under Varied Conditions are Taught in Jefferson County, Colorado, to Discover Effects on Students and Teachers," National Association of Secondary-School Principals. Bulletin, XLII (January 1958), 165-168.

Phi Delta Kappan, XXXIX (March 1958), entire issue.

Pitruzzello, Phillip R. "What is Happening in the Use of Teaching Teams and Teacher Assistants: Report of a Survey," National Association of Secondary-School Principals. Bulletin, XLV (April 1961), 326-328.

Polos, Nicholas C. "Progress in Teacher Education; The Claremont Plan," The Journal of Teacher Education, XI (September 1960), 398-401.

Powers, James R. and Oudet, Simone. "Parlons Francais," Educational Leadership, XVII (December 1959), 148-152.

Price, John W. "More Experience with Utilization of a New School Plant at Syosset, New York, in Contributing to Staff Use and Curriculum Development," National Association of Secondary-School Principals. Bulletin, XLIII (January 1959), 167-180.

Rehage, Kenneth J. "On the Summer School Circuit," The Elementary School Journal, LXI (October 1960), 1-8.

Rinker, Floyd. "Subject Matter, Students, Teachers, Methods of Teaching and Space are Redeployed in the Newton, Massachusetts, High School," National Association of Secondary-School Principals. Bulletin, XLIII (January 1958), 69-80.

Sickels, Rebecca M.; Goodman, Robert and Hollenbeck, Lee. "Speech Teachers Team Up to Improve Sophomore Course," Illinois Education, L (November 1961), 113-114.

Singer, Ira J. "Survey of Staff Utilization Practices in Six States," National Association of Secondary-School Principals. Bulletin, XLVI (January 1962), 1-13.

Slichenmeyer, Harold E. "Arlington Heights, Illinois, Studies Curriculum and Testing, Instruction Assistants, Team Teaching and Modern Technology in Fourteen Projects," National Association of Secondary-School Principals. Bulletin, XLV (January 1961), 41-51.

Smith, Gjertrude. "Verdugo Hills High School, Tujunga, California, Introduces Split Week Courses and Team Teaching to Add Flexibility to the Program," National Association of Secondary-School Principals. Bulletin, XLVI (January 1962), 173-184.

Smith, Vernon H. "Team Teaching Has Advantages," The English Journal, XLIX (April 1960), 242-249.

Stetson, G. Arthur and Harrison, James P. "Junior High School Designed for Team Teaching," The American School Board Journal, CXL (May 1960), 38-42.

Stiles, Lindley J. "Individual and Team Teaching," Wisconsin Journal of Education, XCII (January 1960), 7-10.

Stone, William J. "New Designs for Secondary School Scheduling," California Journal of Education, XXXV (February 1960), 126-130.

Taylor, Harris A. "Claremont Graduate School Program for Team Teaching," The High School Journal, XLIII (February 1960), 277-282.

Tollefson, T. C. "We Use Team Assignments to Help Beginning Teachers," Illinois Education, L (November 1961), 115.

Tracy, Edward. "Easton, Pennsylvania, Team Teaching Program," National Association of Secondary-School Principals. Bulletin, XLVI (January 1962), 145-156.

Trump, J. Lloyd. "A Look Ahead in Secondary Education," National Association of Secondary-School Principals. Bulletin, XLII (January 1959), 5-15.

-----. "Brief Histrpy and Recommendations of the Commission on the Experimental Study of Utilization of the Staff in the Secondary School," National Association of Secondary-School Principals. Bulletin, XLV (January 1961), 275-281.

-----. "More Staff Utilization Experiments are Needed," National Association of Secondary-School Principals. Bulletin, XLII (January 1958), 209-213.

-----. "Others Are Also Extending Horizons in Staff Utilization," National Association of Secondary-School Principals. Bulletin, XLII (January 1958), 197-208.

-----; Gillenwater, Virgil and Rowley, Charles D. "Summer Workshops on Staff Utilization," National Association of Secondary-School Principals. Bulletin, XLIV (January 1960), 316-322.

"Using Team Teaching to Individualize Instruction; Symposium," California Journal of Secondary Education, XXXVI (November 1961), 414-446. (Polos, Nicholas C.; Montague, David O.; Thompson, Scott D.; Smith, Gjertrude; Clark, Arvel B.; Clark, Esmer K. and Warburton, John T.).

Varner, Glenn F. "Team Teaching in Johnson High School, St. Paul, Minnesota," National Association of Secondary-School Principals. Bulletin, XLVI (J anuary 1962), 161-166.

Ward, J. O. "Another Plan for Co-Ordinate Teaching," The American School Board Journal, CXL (February 1960), 10.

Watson, N. E. "Glenbrook High School, Northbrook, Illinois, Projects on Internship, Large Classes, Team Teaching, Teaching Aids and Language Laboratory," National Association of Secondary-School Principals. Bulletin, XLV (January 1961), 51-56.

Weiss, Thomas M. and Morris, Mary S. "Critique of Team Approach," The Educational Forum, XXIV (January 1960), 207-208.

Winget, L.; Lobb, M. Delbert and Bloomenshine, Lee L. "Summary of Speeches on Hurricane, Utah; Jefferson County, Colorado, District R-1 and San Diego, California," National Association of Secondary-School Principals. Bulletin, XLIII (April 1959), 108-112.

Wynn, D. Richard and DeRemer, Richard W. "Staff Utilization, Development and Evaluation; Team Teaching," Revue of Educational Research, XXXI (October 1961), 333-394.

C. UNPUBLISHED MATERIALS

"An Experimental Study of the Utilization of the Staff in Education, Jefferson County, Colorado, School District R-1, Lakewood, Colorado."

Antel, John; Hixon, Elizabeth; Wintering, Joseph and Young, Homer. "Team Teaching, J. Sterling Morton High School, Cicero, Illinois, Staff Utilizatinn Study."

"Evanston Township High School Team Teaching Projects," Evanston Township High School, Evanston, Illinois.

Henry, C. D. "Staff Utilization Project, Summary Report, Snyder Public Schools, Snyder, Texas," January 1960.

Howard, Eugene R. and Heller, Melvin P. "Physical Facilities at Ridgewood High School, Norridge, Illinois," October 1961.

----- and Smith, James E. "Flexible Scheduling at Ridgewood High School, Norridge, Illinois," 1961.

"Report on the Two Year Experimental Project of Staff Utilization, San Diego City Schools, San Diego, California."

"Some Opinions on Teacher Teams," Transcript of a discussion among staff members of the Laboratory School, University of Chicago, February 1961.

"Team Teaching at Riverside-Brookfield Township High School, Riverside, Illinois."

D. PERSONAL VISITATION

Ridgewood High School, 7500 West Montrose Avenue, Norridge 34, Illinois.

Riverside-Brookfield Township High School, Forest and Gulf Road, Riverside, Illinois.

Approval Sheet

The thesis submitted by Michael Lawrence Agin has been read and approved by three members of the Department of Education.

The final copies have been examined by the director of the thesis and the signature which appears below verifies the fact that any necessary changes have been incorporated, and that the thesis is now given final approval with reference to content, form, and mechanical accuracy.

The thesis is therefore accepted in partial fulfillment of the requirements for the Degree of Master of Arts.

4/26/63
Date

Signature of Adviser